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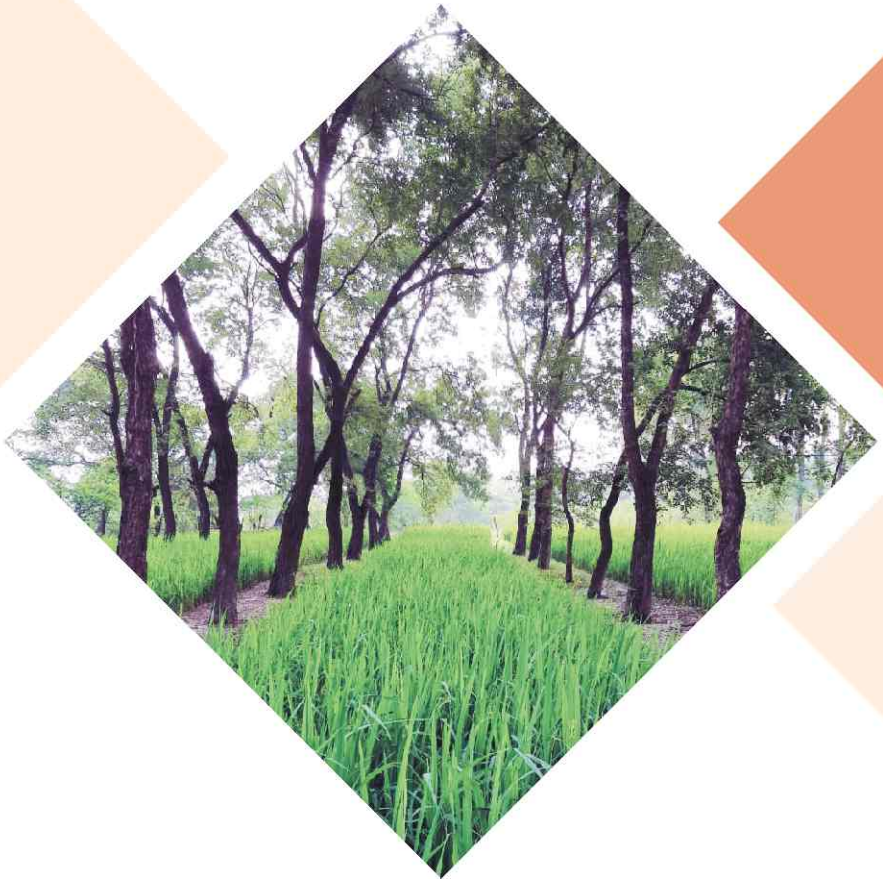
Annual Report 2022



All India Coordinated Research Project on Agroforestry

ICAR-Central Agroforestry Research Institute

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Preface

Agroforestry is one of the best practices for the diversification of agricultural enterprises and integration of the agricultural enterprises for ensuring better returns and reduced risks associated with a variable climate. Currently, it is being practised by millions of farmers the world over and has traditionally been a way of life and livelihood in India for centuries. But now, with technological interventions, it **is** contributing significantly to land use and farm income diversification, and natural resource management and can be one of the major factors in the economic transformation of farmers. The recent studies by ICAR-Central Agroforestry Research Institute, Jhansi have shown that there is approximately 28 m ha area under agroforestry in 15 agro-climatic zones of the country. While we began agroforestry research and development with an ore basic and strategic research, demonstrating the efficacy and motivating the people and other stakeholders for systematic integration of trees into conventional farming systems, now with the adoption of the National Agroforestry Policy and implementation of Sub Mission on Agroforestry, it is more important to access industrial perspectives and quantify the environmental services to call on policy makers to push for concerted efforts on agroforestry.

The All India Coordinated Research Project initiated by ICAR in 1983 has contributed tremendously to providing tree-based land use options. The coordinating centres are conducting recurrent surveys to design new technologies based on the requirements of the stakeholders and evaluating different tree species and their germplasm for higher productivity and adaptability. This annual report summarizes the salient achievements of the coordinating centre and detailed results of each centre.

The guidance received from Dr. Himanshu Pathak, Secretary, DARE and DG, ICAR is gratefully acknowledged. The mentorship role of Dr. S.K. Chaudhari, Deputy Director General (NRM), Dr. S. Bhaskar, Assistant Director General (Agronomy, Agroforestry and Climate Change) and suggestions helped in implementing the project activities. I am grateful to all the Vice-Chancellors and Directors of Research of SAU's and Directors of ICAR institutes, for participating in this project. Thanks are due to OIC's (Agroforestry) at all coordinating centres for their efforts in executing the project at their respective centres.

I record my thanks to all the Scientific, Technical and Administrative staff of CAFRI, Jhansi for their help in the working of this project. My special thanks are due to the scientists of the Project Coordinating unit of the Project for their sincere efforts and help in the execution of the project and preparation of this report.

(A. Arunachalam)
Director, ICAR-CAFRI &
Project Coordinator, AICRP-Agroforestry

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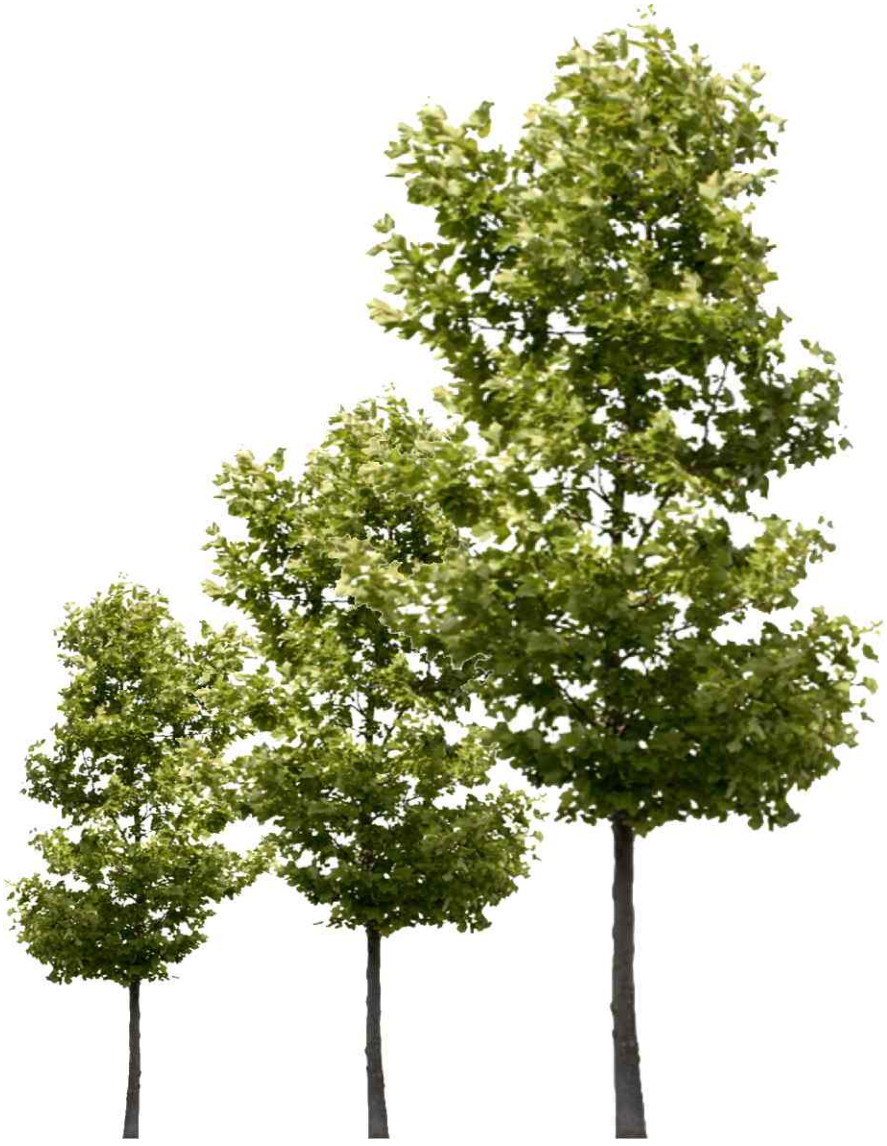


1. कार्यकारी सारांश/Executive Summary

कृषिवानिकी कृषि उद्यम के विविधीकरण के लिए सर्वोत्तम प्रथाओं में से एक है और जलवायु परिवर्तन से जुड़े बेहतर लाभ और कम जोखिम सुनिश्चित करने के लिए कृषि उद्यमों को एकीकृत करता है। कृषिवानिकी पर अखिल भारतीय समन्वित अनुसंधान परियोजना पूरे एशिया–प्रशांत क्षेत्र में एक अद्वितीय नेटवर्क परियोजना है और इसने वृक्ष आधारित भूमि उपयोग विकल्पों के विकास के लिए जबरदस्त योगदान दिया है। सभी 37 समन्वय केन्द्रों (एसएयू से 26, आईसीएआर में 10 और आईसीएफआरई में 01) द्वारा हितधारकों की आवश्यकताओं के आधार पर नई प्रौद्योगिकियों को डिजाइन करने और उच्च उत्पादकता और अनुकूलन क्षमता के लिए विभिन्न वृक्ष प्रजातियों और उनके जर्मप्लाज्म का मूल्यांकन करने के लिए आवर्तक सर्वेक्षण कर रहे हैं। परियोजनाओं के अधिदेश को प्राप्त करने हुए केन्द्र भी सक्रिय रूप से सीमा वृक्षारोपण (हर मेड़ पर पेड़) जागरूकता अभियान, टीएसपी और एससीएसपी कार्यक्रमों में भाग ले रहे हैं।

पिछले वर्ष में चार केन्द्रों ने अपने–अपने क्षेत्रों में निदानकारी और डिजाइन अभ्यास जारी रखा और विशिष्ट सिफारिशें जैसे कि कनकपुर गाँव के जिला–उधम सिंह नगर, उत्तराखण्ड में चिनार किसान बंध/सीमा वृक्षारोपण की तुलना में कृषि वनचरागाह को अधिक पसंद करते हैं लेकिन नीलगिरी के मामले में किसान इसका पालन करते हैं, कृषि–वन चरागाह की तुलना में बंध/सीमा वृक्षारोपण। इसी तरह आधे से अधिक उत्तरदाता शिवमोगा क्षेत्र, कर्नाटक में वृक्ष रोपण हेतु देशी वृक्ष प्रजातियों को पसंद करते हैं। वृक्ष सुधार गतिविधियों के संबंध में बाँस प्रजातियों सहित लगभग 40 वृक्ष प्रजातियां वर्तमान में चल रही हैं और इन वृक्ष सुधार गतिविधियों के परिणामों को विशिष्ट कृषि जलवायु क्षेत्रों के लिए उपयुक्त क्लोन/किस्में/चयन जारी करने के लिए संसोधित किया जा रहा है।

प्रणाली अनुसंधान के सम्बंध में अधिकांश केन्द्र मौजूदा कृषिवानिकी प्रणाली (मॉडल) परीक्षणों/प्रयोगों का मूल्यांकन करने के उद्देश्य से चल रहे हैं जिसमें प्रथाओं के पैकेज में सिफारिश के लिए उपयुक्त फसलों की किस्मों की जाँच शामिल है। कुछ केन्द्रों ने मेलिया आधारित औषधीय कृषिवानिकी मॉडल और आम आधारित कृषि–बागवानी प्रणाली जैसे नये मार्ग भी स्थापित किये हैं। मौजूदा परीक्षणों से वर्ष 2021–22 के परिणाम कृषिवानिकी प्रणालियों की समग्र गणना और मूल्यांकन के लिए सारणीबद्ध हैं।

नर्सरी में 90,000 से अधिक पौध का उत्पादन किया गया और विभिन्न केन्द्रों में विभिन्न अन्य अंतरफसलों के अलावा बेचा या वितरित किया गया। अखिल भारतीय कृषिवानिकी समन्वित परियोजना केन्द्रों ने 2021 के दौरान 10500 से अधिक किसानों को लाभान्वित करने के लिए कृषिवानिकी प्रौद्योगिकियों की शुद्ध पहुँच दर्ज की है। इसके अलावा हमारा केन्द्र कृषिवानिकी व्यवसायिकों

Agroforestry is one of the best practices for the diversification of agricultural enterprises and integration of agricultural enterprises for ensuring better returns and reduced risks associated with a variable climate. The All India Coordinated Research Project on Agroforestry is a unique network project in the entire Asia-pacific region, and it has contributed tremendously to the development of tree-based land use options. All the 37 coordinating centres (26 in SAUs, 10 in ICAR and 01 in ICFRE) are conducting recurrent surveys to design new technologies based on the requirements of the stakeholders and evaluating different tree species and their germplasm for higher productivity and adaptability. Achieving the mandates of the projects, the centres are also actively participating in boundary plantation (Har Med Par Ped) awareness campaigns, TSP and SCSP programmes.

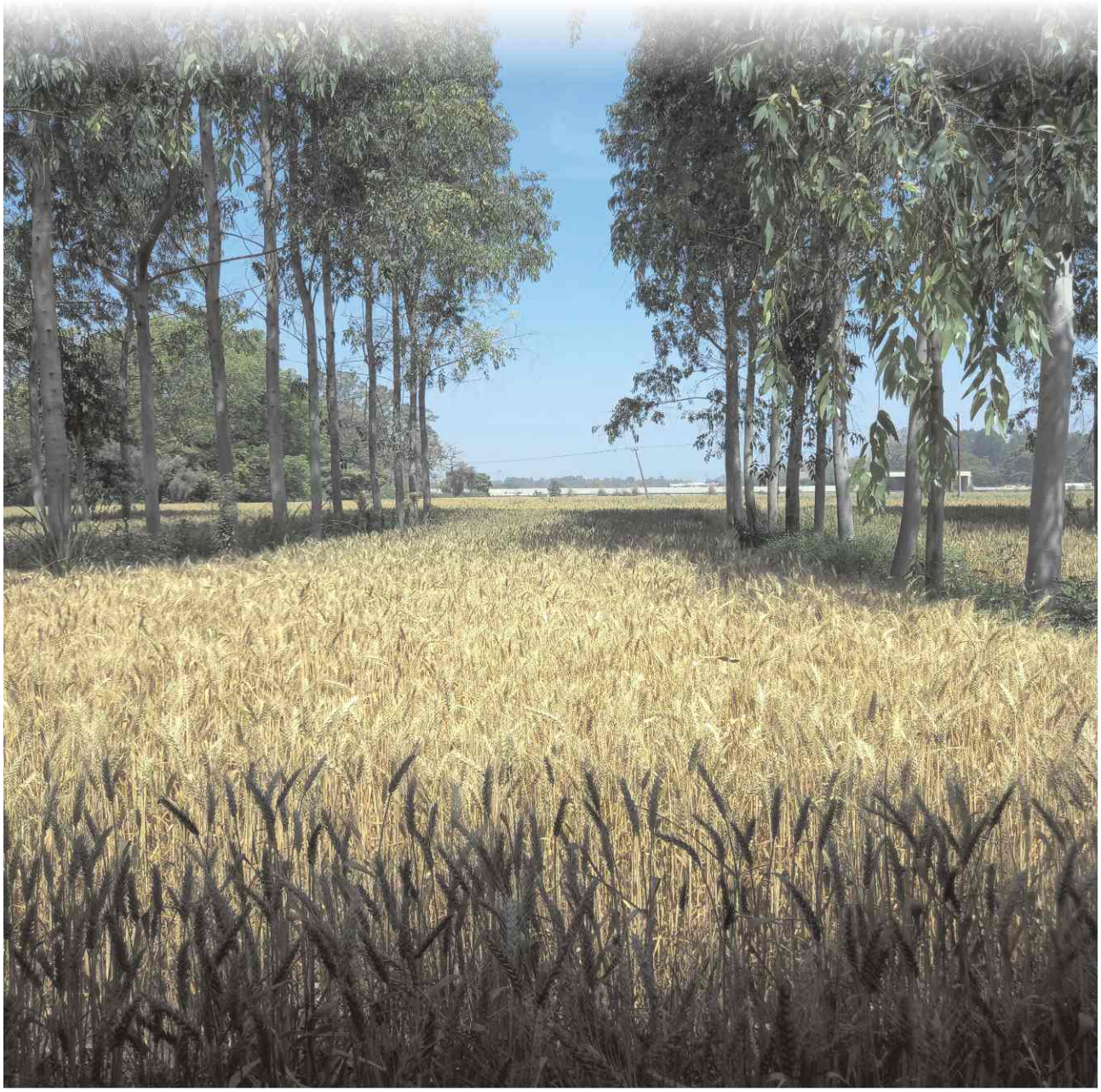
In the last year, four centres continued the diagnostic and design exercise in their respective areas and specific recommendations such as poplar farmers in Kanakpur village Udham Singh Nagar district, Uttarakhand prefer agri-silviculture compared to bund/boundary plantation but in the case of eucalyptus, farmers follow bund/boundary plantation compared to agri-silviculture. Similarly, more than half of the respondents prefer native tree species for planting in the Shivamogga region, Karnataka. With regard to tree improvement activities, about 40 tree species including bamboo species are currently under trial and the results from these tree improvement activities are being processed for releasing clones/varieties/selection suited for specific agro-climatic zones.

With regard to system research, most of the centres are continuing to evaluate the existing agroforestry system (models) trials/experiments with objectives including screening of suitable crop varieties for recommendation in the package of practices. Some centres have also established new trails like Melia based medicinal agroforestry model and Mango based agri-horticulture system. The results of the year 2021-2022 from the existing trials are tabulated for the overall computation and evaluation of the agroforestry systems.

More than 90000 seedlings were produced in nurseries and were sold and/or distributed besides different other intercrops in different centres. The AICRP-Agroforestry centres registered a net outreach of agroforestry technologies to benefit over 10500 farmers during 2021-

को कृषिवानिकी/वृक्ष केन्द्रित कृषि सलाह प्रदान करते हैं। भाकृअनुप–केन्द्रीय कृषिवानिकी अनुसंधान संस्थान, झाँसी और अखिल भारतीय कृषिवानिकी समन्वित परियोजना ने 26 अप्रैल, 2021 को खेत के बांधों और सीमाओं पर पेड़ उगाने की बाधाओं और चुनौतियों पर चर्चा करने के लिए वर्चुवल मोड में ''हर मेड़ पर पेड़'' विषय पर विचार–मंथन सत्र का आयोजन किया गया। अप्रैल 2021 के दौरान कृषिवानिकी पर अखिल भारतीय कृषिवानिकी समन्वित केन्द्रों के लिए कृषिवानिकी फोटाग्राफी प्रतियोगिता का भी आयोजन किया गया था। प्रकाशन के संदर्भ में वैज्ञानिक उत्पादन सहित अन्य गतिविधियों और उपलब्धियों का विवरण भी इस वार्षिक प्रतिवेदन में दिया गया है।

2022. In addition, our centres provide agroforestry/tree-centric agro-advisories to agroforestry practitioners.ICAR-Central Agroforestry Research Institute, Jhansi and AICRP-Agroforestry organized a Brainstorming Session on `Har Med Par Ped' on 26thApril 2021 in virtual mode to discuss the constraints and challenges of growing trees on farm bunds and boundaries. A photography competition on agroforestry was organized for the coordinating centres of AICRP on Agroforestry during April 2021 and the best were conferred prizes. The other activities and achievements including the scientific output in terms of publications are also detailed in this annual report.



2. Introduction

The All India Coordinated Research Project (AICRP) on Agroforestry was started in 1983 with 20 centres and it has now expanded to 37 centres – 26 in SAUs, 10 in ICAR Institutes and 1 in ICFRE Institute representing all agro-climatic zones in the country (Figure 1). The Coordinating unit of AICRP-Agroforestry was shifted from ICAR Headquarters to CAFRI, Jhansi w.e.f. 1st April, 1997 with the following specific mandates:

- ✓ Screening and genetic upgrading of selected plant species for their compatibility in different agroforestry systems
- ✓ To optimize tree-intercrop combination for different regions
- ✓ Performance enhancement of the pre-dominant agroforestry systems being already practiced by the farmers
- ✓ To upgrade and refine the existing technologies for higher productivity and sustainability.

Objectives:

- Diagnostic survey and appraisal of existing farming system and agroforestry practices and farmers' preference.
- Collection and evaluation of promising tree species, cultivars of fuel, fodder and small timber for agroforestry interactions.
- Studies on management practices of agroforestry systems such as agri-silviculture, boundary plantation, silvipasture, silvi-horticulture, agri-silvi-horticulture, multistorey, homestead, etc.
- To analyze economics of agroforestry systems.
- To explore and attribute the role of agroforestry in environment protection.
- To conduct studies on post-harvest technology, fishery, apiculture, lac, *etc*. in relation to agroforestry systems

ICAR-Central Agroforestry Research Institute (ICAR-CAFRI), formerly the National Research Centre for Agroforestry, is a multidisciplinary premier research institute of the Indian Council of Agricultural Research (ICAR) with a major focus on integrating trees, crops, and livestock on the same farmland. The Institute is in Jhansi, Uttar Pradesh (25.5° N 78.5° E), India and has a total area of 254.859 acre (214.079 research farm and 40.78 office & residential area). CAFRI is the only dedicated research institute of the country working on key research areas of agroforestry with 31 scientists, 16 technical, 12 administrative and 8 skilled supporting staff as its sanctioned cadre strength. CAFRI has developed robust agroforestry models and package of practices for different agroclimatic conditions covering small and marginal farmers and provides technical backstopping to the States and stakeholders.

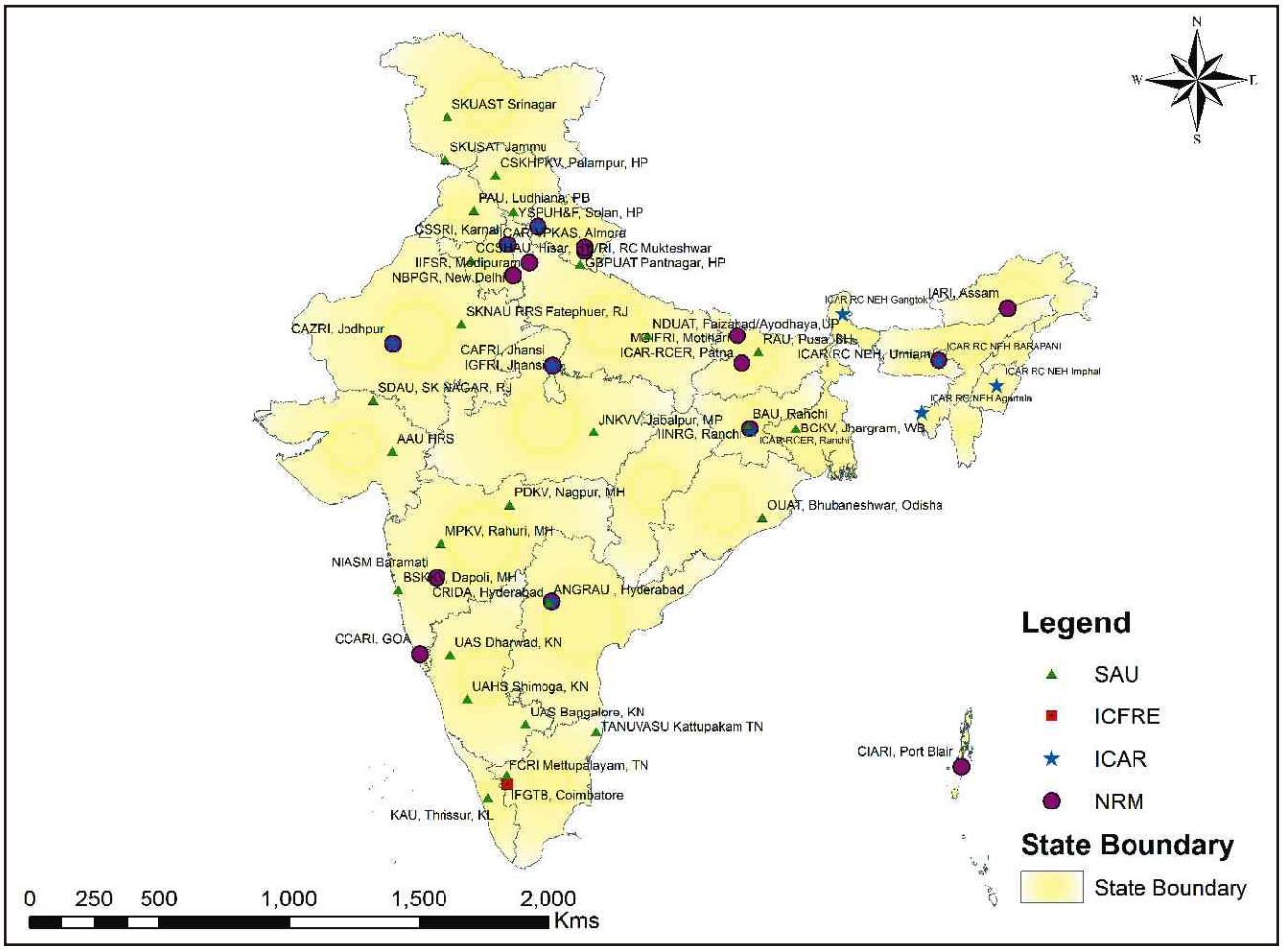


Figure 1. AICRP-Agroforestry Centres across the country

3. Salient Achievements

SK UNIVERSITY OF AGRICULTURAL SCIENCE & TECHNOLOGY-K, SRINAGAR

i) Tree germplasm Collection, Evaluation and Improvement

Survey, collection, multiplication and evaluation of best clones of cricket bat willow (*Salix alba* var. *Caerulea*) in Kashmir.

During the year 2018, the cuttings were collected from other 2 sources *viz*. Pulwama I and II and Anantnag I & II (Five trees from each District) for evaluation in the nursery. After the end of the third growing season, the maximum height of 3.51m was recorded for Pulwama 1 with a collar diameter of 19.08mm. During 2019 the cuttings were collected from two districts of North Kashmir Baramulla and Bandipora, for evaluation under nursery conditions. After the end of third growing season, the maximum survival of 100 percent was recorded for all sources. The best performing saplings were distributed to TSP farmers and sold at kisan mela to buyers for planting in their agroforestry Systems. Baramulla-2 source also performed comparatively better in terms of height (2.45m) and collar diameter (15.01mm). As per QRT recommendation, fifteen clones of *Salix* were collected from Dr. Y.S Parmar University Solan (H.P) in February 2021 and were transplanted in the nursery for further evaluation. After completing one growing season 100% survival was recorded in all 15 clones.

ii) System Research

Evaluation of Apricot-based Agroforestry system under temperate conditions of Kashmir.

After the completion of eight growing seasons, the apricot-based Agroforestry system at Benhama revealed a good potential for the stake holders, Apricot with a maximum height of 4.53 m and collar diameter of 72.21 mm was recorded when grown in combination with Orchard grass followed by 3.80m with tall fescue and collar diameter 70.21 mm with Lucerne. Number of branches (26.48) and fuelwood production (1.46Kg/tree) were recorded as maximum in T_2 (Apricot + Orchard grass). Among the four fodder species *viz*., Timothy, Orchard grass, Lucerne, Tall fescue sown in interspaces and control (natural grass), Orchard grass performed better with green fodder yield of 23.14 t/ha followed by tall fescue with a yield of 15.01 t/ha. Fruit average of 9.21kg per tree was recorded from Apricot trees and after processing oil content was also estimated from the kernels. The average oil content of 39.21% was recorded.

Evaluation of different grasses under apple orchards for developing a workable horti-pasture system under the mountain region of Kashmir valley.

At the end of eight growing seasons, the maximum height (3.10m) and collar diameter (54.29mm) of apple plants were recorded in combination with Sainfoin (T_4) followed by red clover with a height of 3.01m (T_3) and collar diameter of 50.68 mm. The maximum number of branches (28) and (27) were recorded in T_4 and T_3, respectively. The plant spread varied from 0.78 in T_5 to 1.10 in T_4 among the different treatments. The maximum fuelwood per tree (2.52Kg) was recorded inT_4 (Apple + Sainfoin) which was at par with T_3 (Apple +Red clover) and T_2 (Apple + Tall fescue) with 2.50Kg of fuelwood. Although all the growth and yield parameters of apple trees were minimum in T_5 - Control (Apple + Natural grass). Among the various grasses/ legumes *viz*: Orchard grass, tall fescue, red clover, Sainfoin sown in interspaces and control (natural grass), Sainfoin performed better with 17.99 t/ha of green fodder followed by Orchard grass with a yield of 14.01 t/ha. The nutrient status of the soil analyzed at the end of the eighth years revealed a slightly increase in N P K levels. Fruit yield was recorded first time after eight years. An Average 1.0 kgs/tree was recorded for Apple grown with sainfoin followed by 0.5 kg /tree with red clover.

Evaluation of Walnut based Agroforestry system under temperate conditions of Kashmir valley.

At the end of the seventh growing seasons, height, collar diameter, a number of branches and a Plant spread of walnut plants were recorded. The maximum tree height (2.83), Collar diameter (61.13 mm), No. of branches per tree (35.41) and plant spread 2.88 m was observed in T_1 (Walnut + Lucerne). Again, the maximum fodder yield (18.99 t/ha) was obtained in T_1 (Walnut + Lucerne) followed by T_2 (Walnut + Orchard grass) with a yield of 13.93 t/ha. After harvest, CITH-Walnut -1 performed better in terms of fruit weight (29.12 gm per fruit) followed by CITH-Walnut - 3 (22.98gm per fruit) minimum fruit weight was recorded in Sulieman (9gm per fruit). The analysis of soil at the end of the seventh years revealed slight increase in organic carbon and nitrogen over the initial years. However, no particular trend was observed in EC, P and K levels.

Evaluation of Salix based silvi-pastoral system under temperate conditions of Kashmir valley.

Due to animal interferences the experiment from F.V.Sc., Shuhama has been shifted to the Faculty of Forestry, Benhama campus and the trial has been laid out in the month of late February, 2020. This experiment was laid to

evolve different grasses under the allies of *Salix alba* var corella. The best performing selections under nursery conditions were planted in the degraded lands of faculty under Silvipastoral model for further evaluation. During the completion of two growing seasons 100% survival was recorded in case of *Salix alba* raised in all combinations. Among the various grasses *viz*., *Dactylis glomerata* (Orchard grass), *Festuca arundinacea* (Tall fescue) and Sainfoin, the performance of Sainfoin was observed better with green fodder yield of 32.50 t/ha followed by 30.11 t/ha in case of *Salix* + *Dactylis glomerata*+ Sainfoin

Performance of horti-silvi-medicinal and horti-silvi-agriculture system under different apple tree densities under temperate conditions of Kashmir Valley.

The Two Apple varieties Red velox and Gala mast were planted at 4 different densities in the wastelands after little soil working during Autumn 2019 *viz*: T_1 (1.0 m x 3m) T_2, (1. 5 m x 3m), T_3 (2.0 m x 3m), T_4 (2.5m x3m), T_5, (Traditional system). After completion of the third growing season 100% survival was recorded in the case of fruit trees planted at all densities. Fruiting was observed in case of variety Gala mast in the same year & during 3rd year where an average fruit yield of 1.0 kg per tree was recorded in treatment T_2. Beans, when intercropped with Apple, gave maximum production of 41q/ha for first crop and when the beans were intercropped a second time during the same year gave a production of 25q (2.5x3m.) Also, the production of lavender was recorded at maximum in the same spacing, where 248 kg of flowers per hectare was recorded in the first year of planting with an oil content of 0.80%. However, oil content was at par with other spacing. During 2021 Red velox also came in bearing and an average 0.5kg /tree was obtained.

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Tree germplasm collection, evaluation and improvement

Four collections of *Terminalia chebula*, including 3 collections from Himachal and one from J&K are being maintained.

System Research

Development of Silvipastoral System for North Western Himalayan Region

Average tree height and collar diameter readings indicate that the plant height of *Terminalia chebula* ranged from 1.52 m to 2.59 m whereas, the collar diameter of the trees ranged between 34.45 mm to 48.75 mm. The maximum (2.59 m) height of *Terminalia chebula* was recorded in treatment T_7 whereas, the minimum (1.52 m) tree height was recorded in treatment T_1 (Table-2). A similar trend was observed for the collar diameter where, maximum (48.75 mm) collar diameter of *T. chebula* was recorded in treatment T_7 and minimum (34.45 mm) collar diameter was recorded in treatment T_1.

Effect of pollarding on branch wood biomass of *Melia composita*

The experiment was laid out in RBD design with four treatments (T_0, T_1, T_2 and T_3) and seven replications. Four treatments, unpollarded (UP), pollarded at age 3 years (PO), repeat pollarding of PO trees after 2 years (RP) and fresh pollarded at 5 years of age (FP) were imposed on Melia composita planted at a spacing of 6 m x 4 m in a randomized block design. The result revealed branch wood biomass was significantly affected by pollarding. Overall, a reduction in branchwood biomass was observed in all the pollarded treatments compared to unpollarded treatment.

DR. YS PARMAR UNIVERSITY OF HORTICULTURE & FORESTRY, NAUNI, SOLAN

i) Survey, Diagnostic and Design

A diagnostic survey was carried out to study the prevalence of agroforestry systems in mid-hill and high hills of Himachal Pradesh. Study identified the prominent systems as agri-silviculture, agri-horticulture, agri-silvihorticulture, horti-agriculture, silvi-pastoral, agri-hortisilviculture, pastoral-silviculture and horti-pastoral. Among all the systems, biological productivity was highest for silvi-pastoral system in zone-1 (48.28 t/ha) and zone-II (47.70 t/ha), while, agri-hortisilviculture in zone-III (57.83 t/ha) and zone-IV (61.49 t/ha). Agri-silvihorticulture (Rs 66861 yr^{-1}) in zone-I, agri-horticulture (Rs 107933 yr^{-1}) in zone-II and horti-agriculture in zone-III (Rs 378935 yr^{-1}) as well as zone-IV (Rs 344367 yr^{-1}) were economically most productive system in the study area in terms of net revenue obtained from the systems.

Appraisal of existing agroforestry systems in Seraj Valley of Himachal Pradesh identified horti-agriculture, agri-silvi-horticulture, horti-pastoral, agri-hortisilviculture, agri-silviculture. The most predominant agroforestry systems in Seraj valley were horti-agriculture and pastoral-silviculture as the least dominant agroforestry systems. Horticulture component plays a significant role in generating income. By adopting horti-agriculture farmers can earn Rs. 206830 yearly net returns. This income level can further be enhanced by introducing new apple cultivar and the latest cultivation technique.

ii) Tree Germplasm Collection, Evaluation and Improvement

- *Grewia optiva* germplasm collected : 49 entries
- *Morus alba* : 39 entries
- Number of species in the arboretum : 18
- Number of species in the bambusetum : 22

- New germplasm: New germplasm of *Dendrocalmus strictus* and *D. hamiltonii* were collected from different locations (10) of Himachal Pradesh and are being evaluated for their performance.

iii) System Research

Performance of *Abelmoschus esculentus* L. Moench (okra) and *Triticum astivum* L. (wheat) under agri-horticulture land use system:

In the fruit-based agroforestry system, the yield of *Abelmoschus esculantus* enhanced significantly under the apricot-based agroforestry systems than sole cropping. The cultivar Nauni, P-48 gave maximum yield (180.69 q ha^{-1}) with the application of the Farmyard Manure @ 15-ton ha^{-1}. During, the *Rabi* Season cultivation of wheat yield (*Triticum aestivum*) declined by 17 per cent under fruit based AFS than control. Among the fertilizers, application of Jeevaamrut enhanced the yield of Wheat by 16% over the recommended doses of fertilizer.

Effect of tree spacings and nutrient doses on the bio-economic productivity of *Allium Sativum* and *Phaseolus vulgaris* based cropping systems under *Grewia optiva* based Agroforestry system.

The bulb yield and oleoresin content of Garlic varied significantly with *G. optiva* tree spacings and nutrient sources under agroforestry system. The bulb weight per hectare varied from 124.02 q ha^{-1} under open conditions to 92.99 – 114.01 q ha^{-1} under different tree spacings. The bulb weight was maximum (136.85 q ha^{-1}) in treatment of vermicompost @83 q ha^{-1}. The oleoresin content of Garlic enhanced significantly by 33.33 per cent under the sole cropping over the Grewia based agroforestry systems. Further, the maximum (0.27%) oleoresin content in Garlic was obtained in treatment with vermicompost and minimum (0.16%) in control (no application of fertilizer). During the *rabi* season the pod yield of French bean (*Phaseolus vulgaris*) varied significantly from 81.84 q ha^{-1} under open conditions (S_0) to 54.55 – 71.62 q ha^{-1} under differently spaced trees. Among different nutrient sources the pod yield per hectare was maximum (84.54 q ha^{-1}) in treatment with Vermicompost and minimum (55.62 q ha^{-1}) in treatment `Jeevaamrut'. The net returns and benefit cost ratio from cultivation of Garlic under *G. optiva* trees was maximum (Rs. 3.83 Lakh ha^{-1} and 3.27) in spacing S_3 (8 × 3m) with application of poultry manure (T_4). Furthermore, cultivation of French bean under S_1 (8 m × 1 m) *G. optiva* tree spacings (S) with application of beejamrut (T_8) yield the maximum net returns and benefit-cost ratio (Rs.1.43 Lakh ha^{-1} and 2.76).

Effect of organic manures and mulches on the growth and yield parameters of *Allium sativum* L. under *Morus alba* L. based Agroforestry system

The effect of planting conditions and treatments on yield of garlic grown under *Morus alba* based agri-silviculture system showed that the maximum (135.4 q/ha) yield of garlic was recorded under open field condition, whereas, the minimum (130.8 q/ha) was recorded under tree canopy. Application of FYM+VC+ *Grewia optiva* mulch showed maximum yield (141 q/ha), which was 12% more over control.

Studies on crop intercropping under *Grewia* based agroforestry system

The crop intercropping and application of fertilizers under *Grewia*-based agroforestry system as well as open condition has significant effect on the production of *Capsicum annum and Glycine max, Brassica oleracea* and *Lens culinaris.* The yield of *Capsicum annum* and *Glycine max* grown as intercrop, were significantly lower than those obtained from when both the crops were grown as sole crop in open condition with application of recommended doses of fertilizers. The yield of *Brassica oleracea* and *Lens culinaris* perform better under *Grewia* based AFS as the sole crop as compared to intercrop with the application of recommended doses of fertilizers.

Effect of tree spacing and integrated nutrient management on growth and yield of pulses under *Grewia optiva* agroforestry system.

The growth and yield of lentil and black gram have significantly influenced by different tree spacings of *Grewia optiva* and integrated nutrient management. Lentil plant height was recorded maximum (25.67 cm) in S_2 tree spacing whereas, among nutrient management levels maximum height (26.92 cm) was recorded in T_5. The maximum yield of Lentil (340.5 kg/ha) was recorded in under sole cropping with application of recommended doses of fertilizer. During the *rabi* season, the maximum yield (235.36 kg/ha) of black gram was recorded under open field conditions with application of recommended doses of fertilizers.

Effect of planting conditions and organic manures on growth and yield of turnip

In the *Sapindus mukoroshii* based agroforestry systems, the yield of turnip declined by 10 per cent under the tree canopy over the sole cropping. Further, application of RDF yielded 350.23 q ha^{-1}, which is significantly higher than organic sources of nutrients.

Effect of tree defoliator attack on the nutritive value of *Celtis australis*

The crude protein, total ash and neutral detergent fibre were found to be significantly influenced by the defoliator

attack. The crude protein content (21.93%) and neutral detergent fibre (33.77%) was more in undefoliated tree leaves, whereas total ash content (13.94%) was recorded more in undefoliated tree leaves than the undefoliated ones.

To study the effect of defoliation, per cent loss of leaf area, leaves and branch biomass production of *Celtis australis*.

The leaf, branch and total biomass (leaf+ branch) of *Celtis australis* was significantly influenced by defoliation and diameter class. The leaf, branch and leaf + branch biomass enhanced significantly with increasing diameter.

CSK HIMACHAL PRADESH KRISHI VISHWAVIDYALAYA, PALAMPUR

i) Tree Germplasm Collection, Evaluation and Improvement

Out of the best 8 superior seed sources of *Toona ciliata* under field evaluation since 2012, HPI(c)22 seed source of Solan attained significantly higher stem height and DBH in comparison to all other seed sources and it was 89.5 and 124.4% higher than HP 4(c)87, the least performing germplasm source from Kangra. Seed sources from Mandi *i.e.*, HP5(b) 48 and HP 5(b)71 were the next two best performing in terms of growth parameters.

In case of *Sapindus mukorossi*, out of best performing 8 seed sources under field evaluation since 2012, AS 11 of Dhraman was found to be the best performing in terms of growth parameters of height which was statistically at par with AS2 from Chuari and AS8 from Mangla, Distt. Chamba. In case of DBH, it was significantly highest in AS8 followed by AS2. AS1fromBarian, Chamba was the least performing seed source.

ii) System Research

Development of Harar based silvipastoral system for North Western Himalayan region

Different treatments had a significant effect on all the growth parameters of tree and grasses. *Terminalia chebula* attained significantly maximum height (1.8m), collar diameter (56.18mm), secondary branches (14.5) when grown with clover followed by that attained when grown with *Brachiaria* + clover. Number of fruits per plant ranged from 2 to 41 and there was 51-94% pulp recovery. Green and dry fodder yield of the system was highest in case of *Setaria* + Clover (45.57 and 8.35 t/ha respectively) followed by *Setaria* pure. The most important aspect is that quality green fodder can be harvested from the system from April –June when the indigenous grass (T7) is still not rejuvenated from severe winter. Significantly maximum number of cattle (6) or sheep (31) can be fed with *Setaria*+ clover followed by *Setaria* pure (4 and 21 respectively) which was at par with *Setaria*+*Brachiaria*+clover. Cutting treatments had a significant effect on the forage quality parameters of the two grasses and the legume when grown pure or in combination. Total Ether Extract yield was maximum in case of *Setaria* treatment followed by *Setaria*+*Brachiaria*+Clover. CP (%), Ether Extract and useful minerals were maximum at the time of second cut in *Setaria* & *Brachiaria*. Local grass had the least useful minerals whereas maximum was available in *Setaria* + Clover followed by pure clover. In the total carbon sequestered in the system, per cent contribution of grass/legume cover was in the range of 29.45-95.83% whereas trees contributed to the range of 3.3-27.32 t/ha.

Evaluation of *Leucaena leucocephala* germplasm as tree fodder in silvipastoral agroforestry system in mid hills of Himachal Pradesh.

V2 variety (K-8) of *Leucaena* was found to be a high yielder (543.9q/ha) in terms of total dry fodder yield in two cuts. The application of management practices increased the production potential in both varieties. A comparative study of different management practices revealed that pollarding twice a year resulted in maximum fodder production (466.2q/ha) followed by annual lopping treatment.

Quantitative and qualitative evaluation of different varieties of *Morus alba* for fodder under mid-hill conditions of Himachal Pradesh

There was a remarkable increase of 23.9% and 83.8% in the total fresh fodder yield of two varieties China white (V1) and Kanwa-2 (V2) respectively when pollarded twice in comparison to the farmer's practice of lopping. In the case of V3 (S-146), V4 (Ghoshuramay) and V5(S-1635), total yield under treatment of lopping was higher (49.9%, 66.21% and 61.86% respectively) than that obtained in pollarding. Nutritional analysis in the first year of field evaluation revealed that V1 (China White) and V4 (Kanva-2) were qualitatively better varieties of *Morus alba.*

Evaluation of *Melia dubia* clonal plants under mid hills conditions of HP Himalaya

At the end of two-year study, it can be concluded that *Melia* clone (MPT2) of Mettupalayam Centre can prove to be a promising, potential fast-growing timber tree in selected pockets of mid hills which are frost free. It needs further multi-locational testing.

Performance of Turmeric under different spacings and mulches in *Toona ciliata* based Agroforestry system

Different kinds of mulch had a significant effect on amount of sprouts/day. With the application of *Prunus* leaves as mulch, daily emergence count was more as compared to other treatments irrespective of spacing treatments and it followed a gradual curve over the period of one month.

ASSAM AGRICULTURAL UNIVERSITY, HRS, KAHIKUCHI

i) Survey, Diagnostic and Design

Soil consists of new alluvium on both banks of the Brahmaputra and old alluvium towards the foothills. The average annual rainfall in this zone is about 1800 mm and the maximum and minimum temperature rises up to 36^{0}C and falls to 7^{0}C respectively. The farmers rear animal for their livelihood security. The fodder tree used by the farmers is *Artocarpus heterophyllus, Ficus hispida, Ficus gibbosa, Ficus infectoria, Streblus asper, Anthocephallus cadamba, Leucaena leucocephala, Albizia spp., Terminalia tomentosa* and bamboo species. Firewood is one of the major sources of fuel and is generally obtained from trees growing in homestead, farmland and nearby forest areas. Trees such as *Tectona grandis, Dalbergia sissoo, Michelia champaca, Gmelina arborea, Phoebe goalparensis, Terminalia myriocarpa, Shorea assamica, Artocarpus chaplasha* are grown either as block plantation, boundary plantation or in homestead for timber production. Timber and fuel wood species such as *Dalbergia sissoo, Tectona grandis, Gmelina arborea, Bombax ceiba, Ficus spp., Cassia fistula, Melia azedarach,* etc. Multi storied crops like betel vine and black pepper in *Erythrina indica, Cocos nucifera, Areca catechu* trees. Bamboo is an integral part in the homestead – *Bambusa tulda, Bambusa balcooa* and *Dendrocalamus strictus* are generally cultivated. Agar as a shade tree within the small tea garden or homestead tea garden. *Tectona grandis, Michelia champaca, rubber, Bambusa tulda, Bambusa balcooa, Dalbergia sissoo, Gmelina arborea,* Arecanut, Khasi mandarin, jackfruit, and litchi are commonly grown as block plantation.

ii) Tree Improvement

Ninety-five saplings of *Gmelina arborea* collected from 19 seed sources were planted in June, 2001. These were collected from six different sites *viz.* 4 from Goalpara, 3 from Dudhnoi, 3 from Damara, 4 from Boko, 2 from Byrnihat and 3 from Silchar.

iii) System Research

Acacia mangium based AF system

The maximum plant height (16.30 m), dbh (35.97 cm), timber volume (411.98 m^{3}/ha), tree biomass (511.35 Mg/ha) and above-ground carbon stock (252.42 Mg/ha) was recorded in intercrop plot where tree spaced at 5 m x 4 m. The maximum fodder yield of Hybrid napier (50.98 t/ha) was obtained in sole fodder followed by tree spaced at 5 m x 6 m (46.78 t/ha), 5 m x 5 m (40.76 t/ha) and 5 m x 4 m (39.81 t/ha), respectively.

Acacia mangium for timber

Average of 73 superior trees attained 26.3 m plant height and 41.6 cm dbh, 9.16 m canopy diameter and 438.7m^{3}/ha timber volume in the 20th year. Timber volume and tree biomass of the standing tree was 438.7 m^{3}/ha and 498.3 Mg/ha respectively. Above ground C stock observed was 246.05Mg/ha

Jackfruit based AF system

Tree height of 8.79 m was recorded in intercrop plot whereas it was 8.45 m in tree without crop. The dbh (30.14 cm) of jackfruit was superior in intercrop plot in comparison to sole tree plot (29.51 cm). Timber volume, tree biomass and above-ground C stock for jackfruit was higher in intercrop plots, being 60.12m3/ha, 104.55 Mg/ha, and 52.28Mg/ha, respectively. However, canopy diameter (8.16 m) was higher in sole jackfruit. Fruit yield of jack fruit was not increased in 17 year of plantation.

***Gmelina arborea* based agri-silvicultural system**

In nearly 5th year plantation maximum tree ht (6.89 m) collar girth (30.88 cm) were observed insole tree plot and Cowpea-Toria sequence as intercrops respectively. Max canopy dia (2.45 m) was found in GG-Toria sequence as intercrop. Maximum annual increment of tree ht (423.53%), collar girth (309.13%) and canopy dia (337.5%) recorded in GG-Toria sequence as intercrop. No remarkable yield reduction of intercrops observed upto 5th year of plantation.

Growth pattern of *Melocanna baccifera*

Muli bamboo attained 11.69 m in height and 1335 cm in girth at 18 years. The Mean yield of matured bamboo and B:C ratio were 32000 no./ha and 3.51, respectively.

Growth pattern of *Bambusa balcooa*

Mean plant height (25.22 m), spread (5.21 m), new culm (21.45 no.), total culms (144.30 nos.), canopy diameter (32.42 m), biomass (185.25 Mg/ha) and harvestable yield (1276.4 no./ha) of *Bambusa balcooa* was recorded in 13 years after plantation.

Growth pattern of *Bambusa tulda*

Mean plant height (20.56 m), spread (3.79 m), new culm (31.67 no.), total culms (112.33 nos.), canopy diameter (11.49 m), biomass (225.76 Mg/ha) and harvestable yield (2249.3 no./ha) was observed in *Bambusa tulda* in13 years after plantation.

PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

i) Tree Germplasm collection, evaluation and improvement

Poplar (*Populus deltoides)*: 210

Eucalyptus: clones 25 + 20 (PAU)

Shisham (*Dalbergia sissoo)*: clones 23 + 5 (from GBPUAT Pantnagar)

Burma dek (*Melia composita)*: 24 + 20

Melia composita* tree improvement:* A Multi-locational

trial of *Melia composita* was established in 2016 to screen 20 progenies at PAU, Ludhiana and 14 progenies at Ruldu Singh Wala, Bathinda at 4 x 3 m spacing in a well-replicated and randomized block. After five years, the height of progeny 20 was maximum (13.19 m) followed by progeny 19 (12.38 m), progeny 15 (12.13 m) and progeny 13 (12.0) and the DBH was maximum that of progeny 19 (20.80 cm) followed by progeny 20 (16.94 cm) and progeny 16 (16.79 cm). The best performing progenies were from TNAU (TNA2 and TNA5) which shows that these progenies maintain their superiority even across regions. Progeny 3 performed best at both locations and was consistently uniform within replication.

Poplar tree improvement: A multi-locational trial for evaluation of 15 clones of poplar (5 from Pantnagar, 3 from HAU and 7 from PAU) was established at PAU Ludhiana and RRS Bathinda in January 2014. After 7-year growth, the lowest DBH (17.23 cm) was of HAU-S1 and the highest (20.73 cm) of PP9-25 followed by PP9-20 (20.40 cm). The minimum height (17.53 m) was in PP9-29 and the maximum (19.75 m) in FNR-357. Based on better performance at different centres, some promising clones could be recommended for the region.

Shisham (*Dalbergia sissoo*): Plus trees were selected and progeny trials were established. The promising genotypes were cloned, and five clones were introduced from the GBPUAT, Pantnagar. A Zonal clonal trial was established at three locations, *i.e.*, PAU, Ludhiana; GBPUA&T, Pantnagar; and HAU, Hissar. Plants of eight clones were established at Ludhiana following RBD. The DBH and height recorded at age 4.5 years varied from 9.96 to 12.33 cm and 8.52 to 10.86 m, respectively. The top rank with respect to DBH was found in the case of PS 54, and was followed by PS 52 and PAU-2. The volume index (m^3/tree) of the shisham clones at the age of 54 months, Clone PS-54 attained the maximum value (0.159 m^3/tree), which was at par with that of PS-52.

ii) System research

Performance of poplar and intercrops

The average tree height and diameter of 5-year-old poplar (8 x 2.5 m spacing) recorded was 14.2 m and 16.6 cm with a crown spread of 16.7 m^2. Under poplar, the significant increase in seed yield of **Indian mustard** cultivars was up to 150% RDF: $N_{150}P_{45}$ kg/ha (1595 kg ha^{-1} respectively), whereas, in open conditions, it was up to 125% RDF (1726 kg ha^{-1}). PBR 357 variety recorded significantly higher seed yield under poplar (1293 kg ha^{-1}) and under open conditions (1582) compared to Giriraj and RLC 3 variety. **Onion:** Six onion varieties (POH-1, PRO-6, PRO-7, PWO-2, PYO-1 and Punjab Naroya) were transplanted at four planting times (mid-December, end-December, mid-January and end-January) under poplar. PRO-7 variety recorded a significantly higher bulb yield (24.4 t/ha) than the rest of the varieties. Planting of onion crop gave better bulb yield in mid-December (23.3 t/ha) than end December (19.1 t/ha) and mid-January planting (16.3 t/ha). The per cent reduction in bulb yield under five-year-old poplar was 36.70. The benefit-cost ratio of the poplar-onion model was higher (2.94) as compared to poplar-wheat (2.74) and sole onion (1.92).

Development of eucalyptus-based agroforestry system for Indo Gangetic plain

An experiment has been initiated during September 2016 to develop the eucalyptus-based (8.0 x 2 m) agroforestry system at four centres in Indo Gangetic zone (PAU Ludhiana, Pantnagar, Hisar, Ayodhya, Pusa Bihar). After 4 years, the mean height and DBH of the eucalyptus trees ranged between 6.41 to 17.2 m and 8.78 to 16.7 cm at Ayodhya and Hisar centre, respectively. During *rabi* season, wheat, mustard and berseem crops were intercropped with eucalyptus trees. The wheat crop recorded an average of 4.5, 3.7, 3.0 and 1.91 t/ha of grain yield in wheat-moong and wheat–mash rotation at PAU, HAU, Pantnagar and Ayodhya, respectively. The mustard crop recorded yield of 0.44, 1.30, 1.56 and 0.97 t/ha in mustard-moong rotation at all four centres, respectively. The maximum berseem yield of 41.6 t/ha was recorded at HAU followed by Pantnagar (31.73) and PAU (27.8 t/ha). In *kharif* season, the moong crop recorded yield of 1.09, 0.23, 0.65 and 0.46 t/ha in wheat-moong rotation at Pantnagar, PAU, HAU and Ayodhya respectively. The yield of cowpea fodder was recorded highest 21.7 t/ha at PAU followed by 14.52 t/ha at HAU.

GB PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR

i) Survey, Diagnostic and Design

For the year 2021-22, D & D survey was conducted in Rangaon village of Thalisain Block in Pauri Garhwal District of Uttarakhand.

ii) Tree Germplasm collection, evaluation and improvement

- 94 + 54 multipurpose tree species including 21 species of bamboos had been collected over the period and being evaluated for their growth pattern, phenology, insect pests and disease incidence, *etc*.
- For the poplar provenance trial and germplasm bank experiments, growth data have been stabilized therefore no further observations are being taken any more.
- For the comparative performance of promising eucalyptus clones under agroforestry, the growth

data have been stabilized therefore further growth observations are not being recorded.

Since in these experiments' growth data are no longer being taken but qualitative data being observed on disease, mortality etc. Human interfere is most challenging burden for tree survival.

Shisham coordinated trial

- At Ayodhya, clone PS-52 showed maximum height and DBH.
- At Pusa, clone PS-90 showed maximum height and clone PS-38 had highest DBH.
- At Hisar, highest growth and DBH was attained by clone PS-38 .
- At Ludhiana, the maximum height was observed in PS-52, while highest DBH response reported in PS-54.
- At Pantnagar clone growth observations were not made as plantlets were too small. Due to the highway expansion experiment was reinitiated in year 2021.

Coordinated Eucalyptus Management Trial

Growth performance of different Eucalyptus species and hybrid

Trees growth is observed where mean height and DBH are respectively 15.26 m and 32.83cm.

Crop yield under tree is significantly reduced.

No major changes in the soil parameters are observed.

iii) System Research

Carbon sequestration potential of Poplar and Indian mustard under Agroforestry system:

Under poplar-based agroforestry system, total biomass deposition, ground biomass accumulation (ABG), belowground biomass (BG) and carbon dioxide mitigation for 10 diverse Indian mustard genotypes crop was recorded. As expected significantly high biomass deposition for *Brassica* was observed in open field as expected then the in the AF system. Although different verities had varied response under AF system and open filed. The *Populus deltoides* trees of agroforestry system contributed for total biomass during cropping season, where aboveground biomass accumulation (ABG) was significantly higher than belowground biomass (BG) of *P. deltoids* trees. During season, carbon dioxide mitigation was recorded significantly higher in the poplar + mustard then in open field. When compared to agroforestry system, the overall quantity of carbon dioxide mitigation provided by mustard crop in open fields was less. The sole crop grown in open field has reported low amount of CO_2 fixation when compared to agroforestry systems of poplar as crop plant can only sequester small amount of carbon dioxide through crop residue and roots. In mustard crop, genotypes with maximum dry matter production were actively involved in CO_2 mitigation although in small amount compared to tree species.

Evaluation of rhizospheric physio-chemical and biochemical parameters under different *Bambusa* species.

The soil pH ranged in the neutral range. The soil pH and EC was positively correlated. In the present study the highest organic matter was recorded in *Bambusa bambos* while the lowest organic matter was in *Bambusa nutans*. The variations in organic matter may be due to degree of leaf falls, rhizospheric microbial and enzymatic activity and aeration. The electrical conductivity was also positively correlated to organic carbon and with organic matter. Due to increased organic carbon in soil, microbial activity increases so electrical conductivity was positively correlated to organic carbon. Rhizospheric soil from different bamboo species also had significant volumes of available NPK. Nitrogen is positively correlated to potassium, organic carbon and organic matter but negatively to phosphorus. The available phosphorous was positively correlated to pH only. Keeping in view the available nutrients in the soil, high soil enzyme activity for the β Glucosidase, Alkaline phosphatase and Acid protease were high activity n bamboo species rhizospheres.

Screening of rice line for light sensitivity under Eucalyptus based agroforestry system

Out of 20 genotypes tested, all but one line could not survive in open filed as well in Eucalyptus based AF system. Flowering was observed in only 40% lines in open as well as in Eucalyptus based AF system. All the flowering lines (Open and AF) produced chaffy panicle, hence agronomical yield of different lines was not measured. Based on growth (plant height, number of tiller) parameters and biochemical (chlorophyll content) observations, it can be concluded that Eucalyptus agroforestry system can sustain rice cultivation for the genotypes which can grow under light stress conditions.

ACHARYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KUMARGANJ, AYODHYA

Tree Germplasm Collection, Evaluation and Improvement

Shisham clones:

Various shisham clones collected from, HAU, Hissar and Uttar Pradesh: We have been collected five shisham clones from HAU, Hissar namely PP-09, PP-16, PP-21, PP-22 and PP-39 and Local collections from Para Sultanpur, Baraipara, Ayodhya and Mai, Barabanki during 2016-2017. In the year 2021-2022 highest tree height have been obtained in PP-39 (6.62 m) followed by PP-09 (5.58 m) and PP-21 (5.27 m).

The maximum dbh was also recorded in the same clone PP-39 (14.72 cm) followed by PP-16 (11.53 cm) and PP-09 (11.14 cm). While in local collections Baraipara, Ayodhya performed better plant growth like tree height (5.94 m) followed by Para Sultanpur (5.61 m). Baraipara, Ayodhya clone showed higher dbh (11.26 cm) followed by Para Sultanpur (10.15 cm).

Eucalyptus clones

Various Eucalyptus clones have been collected during the year 2010-2011, namely Eu-316, Eu-2135, Eu-3135, Eu-416A and Eu-416. The maximum tree height has been obtained in Eu-3135 (10.92 m) followed by Eu-2135 (10.89 m). Maximum dbh was recorded in same clone Eu-3135 (15.20 cm) followed by Eu-2135 (12.20 cm). The maximum crown width was recorded in Eu-2135 (2.71 m) followed by Eu-3135 (2.67 m).

Agri-silviculture System

Significantly higher grain yield of paddy variety Sarjoo-52 (2.27 t ha^{-1}) was found under *Dalbergia sissoo* while mustard variety Varuna showed higher yield (1.06 t ha^{-1}) than others varieties *Casuarina equisetifolia* based agri-silviculture system. As per paddy-mustard based sequence. The maximum urd grain yield in variety Narendra Urd-1 (0.47 t ha^{-1}) which found significantly superior over other varieties of urd under *Dalbergia sissoo* based agri-silviculture system. As per organic fertilizers-based experimentation, the maximum grain yield of paddy var. Sarjoo-52 (2.21 t ha^{-1}) has been obtained with the application of FYM 10 t ha^{-1} under *C. equisetifolia*, while higher grain yield of wheat var. NW-5054 (2.18 t ha^{-1}) was also recorded by the application of same treatments *i.e.*, 10 t ha^{-1} FYM under same system *i.e.*, *C. equisetifolia* based agri-silviculture system. Under *Eucalyptus* based agroforestry system for Indo-gangetic plains, the maximum plant growth with tree height (9.16 m) and dbh (12.23 cm) were recorded for T_1 treatment (Moong-Wheat) as compared to other treatments.

Agri-silvi-horti system

Significantly higher turmeric rhizome yield (7.05 t $ha^{-1}yr^{-1}$) has been obtained due to application of 50% recommended dose of NPK (120:80:80 kg ha^{-1}) + 50% FYM dose (recommended dose 20 t ha^{-1}) as compared to other treatments under agri-silvi-horti system. Moreover, turmeric also has medicinal importance which attached significant in improving health of the people of the country.

Silvi-pastoral system:

In the *Dalbergia sissoo* based silvi-pastoral system, the maximum annual green fodder yield was found for *Pennisetum purpureum* (43.62 ha^{-1}), followed by *Panicum maximum* (31.11 t ha^{-1}) and *Brachiara mutica* (26.31 ha^{-1}).

Achievements of the provenances/varieties/genotypes established from different places:

Under tree improvement project of shisham, from growth performance, PS-52 showed highest plant height (2.90 m) followed by PS-54 (2.41 m) and L-1 (2.38 m). Higher dbh (7.28 cm) also recorded in same clone PS-52. The maximum number of branches (26) counted in PS-52 and L-1 (26). The higher crown spread (82.30 cm) was measured in PS-52 followed by PS-20 (73.25 cm). Under Eucalyptus based agroforestry system for Indo-gangetic plains, from plant growth performance, amongst 5 treatments including control (open area), the maximum tree height (9.16 m and dbh (12.23 cm) were recorded T1 treatment (Moong-Wheat). The maximum number of branches (48) recorded in T1 (Moong-Wheat) and crown spread (2.43 m) in T3-Urd-Wheat. The higher moong grain yield (0.51 t ha^{-1}) as *kharif* intercrop was obtained in T1 (Moong-Wheat) treatment as compared to T3-Moong-Mustard (0.37 t ha^{-1}) under system, while in open area higher Moong yield (0.58 t ha^{-1}) was obtained as compared to system in T1 treatment. The higher wheat grain yield as *rabi* intercrop (1.97 t ha^{-1}) was recorded in T1 treatment in Urd-Wheat (T3) under system, while in open area comparatively higher grain yield of Wheat (2.53 t ha^{-1}) was observed in the T1 treatment.

DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, SAMASTIPUR

I) Tree Germplasm Collection, Evaluation, and Improvement

Evaluation of Different Genotypes of Shisham (*Dalbergia sissoo* Roxb.) for Agroforestry System in the Indo-Gangetic region

Morphometric measurements in terms of height and DBH for 5-year-old plantations of eight different *Dalbergia sissoo* genotypes showed the maximum tree height for genotype PS-38 (7.27 m) which was statistically at par with PS-20 (7.13 m), PAUL#2 (6.93 m), and PS-52 (6.72 m). On the other hand, DBH which ranged from 9.53 (PAUL#5) to 12.26 cm (PS-38) did not show any marked difference. All the species showed an increasing trend of mean annual volume increment up to the 4th year and after that, they started to decline.

Evaluation of Different Clones of Poplar (*Populus deltoides* Bartr.) Plantations for their Growth and Productivity

Out of 18 five-year-old poplar clones, PP 9-OPR-1 (13.17 m), G-48 (12.33 m), PP 9-25 (12.03 m), and PP 9-J1 (11.5 m) performed better in terms of height. On the other hand, the DBH of PP 9-OPR-1 (15.07 cm) and G-48 (14.23 cm) was significantly superior. The maximum volume for PP 9-OPR-1 was 0.184 m^3/tree which was at par with G-48 (0.154 m^3).

By and large, taking both the parameters into consideration, PP-9-OPR-1 and G-48 were superior.

System research

Performance of Semal (*Bombax ceiba* L.) based agri-silvicultural system in calcareous soil.

To examine the effect of different spacings, *i.e.*, 5×2 m, 5×3 m, 5×4 m, and 5×5 m of six-year-old *Bombax ceiba* L. based agri-silvicultural system on soil physico-chemical properties, available N, P_2O_5, and K_2O were highest in highest density plantation (5×2 m spacing) and increased by 15.0, 38.3 and 20.1% in 0-15 cm soil depth, respectively. The total SOC storage from 0-30 cm soil depth in plantations of different densities increased by 32.9% in 5×5 m and 71.8% in 5×2 m spacings. By and large, it is concluded that higher density plantations (5×2 m and 5×3 m) of *B. ceiba* proved to be the best for improving SOC and soil available macronutrients.

Seasonal litterfall was found higher in the winter season followed by the rainy season. During the summer season, there was no litterfall. In the winter season 54.4, 56.0, 59.8, and 58.6%, and in the rainy season 45.6, 44.0, 49.7, and 41.4% of litterfall occurred in 5×2 m, 5×3 m, 5×4 m, and 5×5 m spacings, respectively. The significantly higher litterfall in both seasons was observed in 5×2 m spacing.

Irrespective of the tree density, nutrients returned through litterfall followed the order Ca > N > K > Mg > P. Among the different spacings, the plantations of the lowest spacing (5×2 m) *i.e.,* highest density (1000 trees ha^{-1}) showed a significantly highest nutrient return to the plantation floor.

Leaf litter decomposition of *B. ceiba* was found faster in higher density (5×2 m and 5×3 m) plantations than in lower density (5×4 m and 5×5 m). In higher density plantations it took 11 months and in lower density, 12 months for total litter decomposition. The decay constant values (k) of leaf litter varied between 0.00809 (5×5 m) and 0.00972 (5×2 m). The half-life values of leaf litter decomposition were higher for lower densities (82 and 86 days) when compared to higher densities (71 and 80 days). Both, N concentration vs. leaf biomass remaining and P concentration vs. leaf biomass remaining with the time elapsed showed negative and non-significant relationships. On the other hand, correlation coefficient values for K concentration vs. leaf biomass remaining varied from 0.936** to 0.941** showing a positive and significant relationship with biomass remaining.

Bamboo plantations in Dhab (riverside) area of Gandhak river

To utilize the barren sandy soil of the Dhab area of Burhi Gandhak river, 450 bamboo plants were planted at 6×6 m spacing in 1.68 hectares of land. These bamboo plants are being irrigated with a sub-surface drip irrigation method operated by a floating boat-mounted solar energy-based pumping system. At the age of the 3-year-old plantation, the overall survival percentage was recorded at 67%. The growth parameters in terms of height, girth, and the number of culms varied between 4.5–9.5 m, 10.5–21.5 cm, and 4-22, respectively. The height and girth of these bamboo plants showed almost 1.25 times more growth than that grown in control (*i.e.*, plants grown without irrigation and fertilizer).

ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESHWAR

i) Survey, Diagnostic and Design

Diagnostic and Design survey related to homestead agroforestry was undertaken in two districts (Khurda & Jagatsinghpur) comprising two blocks and two villages. A total number of 100 farmers were interviewed as per the pre-structured questionnaires. Many heterogeneous species of trees, shrubs, vegetables and herbaceous plants are grown in random arrangements with dense plant population. The home gardens are characterized by high species diversity and usually 3-4 vertical canopy strata. These consist of an herbaceous layer near ground, a tree layer at the upper level and two intermediate layers. The upper most layer is tree layer which can be divided into two, consisting of the emergent full-grown timber and fruit trees having height more than 20.0 m and medium size trees of 10-20 m. In the upper layer, species like *Samanea saman*, *Bambusa vulgaris*, *Bambusa tulda*, Jamun, coconut, arecanut, jack fruit, bael, tamarind, neem, subabul, etc. are grown.

ii) Tree Germplasms Collection, Evaluation and Improvement

EVALUATION OF TREE SPECIES

Seven entries of *Gmelina arborea* collected from three states of India *viz*. Odisha, West Bengal and Assam on 78 months after planting. The *Gmelina arborea* entries of Durgaprasad recorded significantly highest plant height (5.24 m), basal girth (25.84 cm) and crown spread (6.88 m) at 78 months after planting. The lowest plant height of 3.94 m, basal girth 19.07 cm and crown spread 4.53 m was found with Jhargram, WB at 78 MAP.

iii) System Research

Fruit based agrisilvihorticultural system

Relative performance of four short duration inters crops (Mango ginger, Turmeric, Colocasia and Arrowroot) was studied in agrisilvihorticultural system involving three fruit tree species (Mango, Jackfruit and Cashew). The tree growth parameters and the effect of trees (78 months old) on growth and yield of intercrops were assessed in relation

to their sole crop yields. The highest plant height was recorded with the intercrop Mango ginger with Jackfruit followed by Mango and Cashew (8.26 m, 6.21 m and 5.37 m) respectively. Similarly, the basal girth and crown spread recorded highest with the intercrop Mango ginger followed by Turmeric with the fruit trees. Turmeric produced the highest net return of Rs 324250 Rs 285250 and Rs 198700 /ha/yr with BCR 3.01, 2.64 and 1.84 with three fruit trees *i.e.*, Jackfruit, Mango and Cashew respectively followed by Mango ginger.

Silvipastoral system

The tree growth after 78 month was highest in *Acacia mangium* with setaria (height 17.8 m, DBH 15.8 cm and crown spread 10.5 m) followed by *A. auriculiformis* (height 14.8 m, DBH 12.6 cm and crown spread 9.1 m) and lowest tree height of 5.4 m, DBH 7.6 cm and crown spread 3.9 m were recorded in *S.saman* with thin napier recorded after 78 months of planting. The solar radiation interception was lowest with *A. mangium.* Better moisture storage was evident with *A. mangium* followed by *A. auriculiformis* and S .*saman*. The higher chlorophyll content was observed with sole grasses than the system from August to October but during November it was higher in the system than the open field condition, which might be due to more availability of soil moisture in the system. The maximum green forage yield was obtained from Guinea (16.1 t/ha) from three cuttings and Thin Napier was the next best with a yield of 13.9 t/ha during 2021. In the system approach, highest benefit: cost ratio based on Net return was obtained from Guinea grass (3.73) in association with *A. mangium*.

Gambhar based agrisilvicultural system

The *G. arborea* in agrisilvi system after 78 months of planting recorded the highest tree height & basal girth of (7.28 m and 35.87cm) in *Gmelina arborea* + Green gram-Toria followed by *Gmelina arborea* + Cowpea-Toria (6.74m and 32.66) system. The highest values of soil available N (266.8 kg/ha), K_2O (122.5kg/ha) and available P_2O_5 (44.8 kg/ha) were with green gram-toria. *G. arborea* + cowpea-toria recorded the highest arhar equivalent yield of 964 kg/ha and the net return of Rs 22,120 /ha and BCR of 0.41.

Mango + pineapple agrihorticultural system

During the investigation period the growth parameters of mango trees such as tree height (9.5 m), basal girth (1.11 m), crown height (7.7.m), crown spread (7.6 m) and number of branches (9.8) were recorded highest with RDF (125%) + FYM. Drip irrigation recorded highest growth parameters of mango trees irrespective of its nutrient management practices. The biometric observation of pineapple such as D-leaf length (67.3 cm), plant height (93.9 cm), crown spread (151.7 cm) and number of leaves (49.3) were observed highest with RDF (125%) + FYM and similar trend also followed in pineapple with drip irrigation system. Organic nutrient application recorded highest Total Soluble Solid (17.34 0brix and 17.12 0brix), acidity (0.62 & 0.14), reducing (5.01 & 7.97) and non-reducing sugar (5.79 & 9.49) of pineapple and mango fruit respectively among the four nutrient treatments, while RDF (125%) + FYM recorded the lowest. Among the application of four recommended dose of fertilization, RDF (125%) + FYM found to be the best & this resulted the highest yield of mango and pineapple (72.39 q ha^{-1} and 93.82 q ha^{-1}) with highest gross return of Rs 5.65 lakhs per year per ha, net return of Rs 4.02 lakhs per year per ha and BCR 3.46. Similarly, among water supply systems, drip system resulted in utmost gross return, net return and BCR values were noted down *i.e.*, Rs 5.20 lakhs per year per ha, Rs 3.62 lakhs per year per ha and 3.19 in comparison to sprinkler and ridge furrow method of irrigation.

Agrisilvicultural System

Tectona grandis with paired row planting of Pineapple of 0.6-1.0×0.3 m^2 of Chandaka provenance (T_8) attained maximum value of pH (5.62), organic carbon (0.58 gm/kg), Available N (280.7 kg/ha), available P (41.7 kg/ha), available K (200.4 kg/ha). Among all the treatments tree height, DBH and crown spread were highest for *Tectona grandis* with single row spacing of Pineapple 0.8 x 0.6 m^2 of Chandaka provenance(T_5) *i.e.* 26.2 m,23.3 cm and 2.3 m respectively. The maximum value of aboveground biomass (92,752 kg/ha), belowground biomass (24,115 kg/ha), total biomass of the system (1,16,868 kg/ha), carbon sequestration (58,434 kg/ha), carbon credit (3,506 USD) and carbon assimilation (1,93,007 kg/ha) were obtained in *Tectona grandis* with single row spacing of Pineapple 0.8×0.6 m^2 of Chandaka provenance (T_5). The above parameters were found minimum in *Tectona grandis* with paired row planting of Pineapple of 0.6-1.0 x 0.3 m^2 of Nuapada provenance(T_4). Highest value of average number of leaves per plant (26), length of D leaf (61cm) and number of suckers per plant (4.9) of Pineapple were obtained in single row spacing under *Tectona grandis* of Chandaka provenance *i.e.*T_5 Shrub height (89.4 cm) and dry biomass (6,099 kg/ha) of Pineapple were obtained highest in *Tectona grandis* with paired row planting of Pineapple of 0.6-1.0 x 0.3 m^2 of Chandaka provenance *i.e.*T_8 followed by T_4 of Nuapada. Among all the treatments B:C Ratio and net return were highest for *Tectona grandis* with paired row planting of Pineapple of 0.6-1.0 x 0.3 m^2 of Chandaka provenance *i.e.*, T_8(1.90 and Rs 6,08,000/ha) and lowest for *Tectona grandis* with single row spacing of Pineapple 0.8 x 0.6 m^2 of Nuapada provenance *i.e.*T_1(1.56 and Rs 4,99,200/ha).

BIDHAN CHANDRA KRISHI VISHWA VIDYALAYA, RRS, JHARGRAM

i) Survey, Diagnostic and Design

Survey among farmers in different villages of Jhargram, Binpur II of Jhargram district; Salboni of Paschim Medinipore for extension of agroforestry systems in farmers' plots. On-farm Demonstration of gamhar (Gmelina *arborea* Roxb.) - mango (*Mangifera indica* L.) based AF models with pigeon pea (*Cajanus cajan* (L.) Millsp.), boundary plantation with gamhar and bamboo, homestead agroforestry and gamhar-sweet orange-based AF has been done.

ii) Tree Germplasm collection, evaluation

Periodic observations of the multipurpose trees of *Gmelina arborea* (2005 & 2010) and *Acacia auriculiformis* (2002, 2005 & 2010) on height, diameter at breast height (DBH), bole height and volume yield have been recorded to identify superior germplasms in terms of growth habit and timber quality.

iii) System research

Biometric observations of trees, growth and yield of inter crop, different soil properties were recorded of the following experiments to evaluate the possibility of increasing the productive capability of land and to achieve sustainable nutritional and ecological security.

1. Effect of alley cropping and mulching on early growth of Gmelina- ber agroforestry system.
2. Studies on the growth and productivity of different intercrops grown within the row spaces of *Neolamarckia cadamba* - mango agroforestry system.
3. Studies on the growth and productivity of different intercrops grown within the row spaces of *Dysoxylum binectariferum* - mango – based agroforestry system.
4. Evaluation of gamhar based Agri-silvicultural system (common experiment for humid and sub-humid zone).

BIRSA AGRICULTURAL UNIVERSITY, RANCHI

i) Tree Germplasm Collection, evaluation and improvement

Evaluation of Multipurpose Tree Species (MPTs) for Adaptability and Growth performance at Ranchi District

After four years of plantation of multipurpose tree species, the maximum average height (9.51 m) was observed in treatment having species *Acacia auriculiformis* followed by species *Dalbergia sissoo* (4.54 m). Whereas, maximum DBH (7.72 cm) were observed in species *Acacia auriculiformis* followed by in species *Melia azedarach.* (4.99 cm). The maximum height and DBH increment were found in species *Acacia auriculiformis* (3.12 m) and (4.30 cm) respectively. Data on soils revealed that maximum improvement in soil pH (5.29), organic carbon (0.37), N and P 198.11kg/ha and 11.92 kg/ha respectively in Neem followed at par in Gamhar. whereas, maximum available potassium (98.32 kg/ha) is found in Karanj.

ii) System Research

Evaluation of *Gmelina arborea* based Agri-Silvicultural System

Data of height increment of trees after four years with different crops revealed that maximum height growth increment was recorded in Sole Gamhar (0.83 m) followed by growth increment of Gamhar with cowpea (0.75 m). Whereas, minimum height increment in tree was observed in treatment Gamhar with Black gram (0.61 m). So far as DBH increment is concerned that maximum DBH growth was recorded in Gamhar with Black gram (1.98 cm). Blackgram equivalent yield (q/ha) was calculated for other two crops *viz*, cowpea and Pigeon Pea. Significantly cowpea recorded maximum equivalent yield 11.25 q/ha in treatment combination *Gmelina arborea* + cowpea and minimum equivalent yield (8.50 q/ha) was recorded in black gram as sole treatment. Surface soil pH was acidic in reaction; organic carbon percentage and available nitrogen content, available N, P and K were low. After harvesting, analyzed soil data revealed that there was improvement in soil pH, organic carbon and nitrogen and phosphorous was observed in treatment combination of Gamhar with Pigeon pea. Significantly maximum soil pH (5.31), OC% (0.37), N (198.37 kg/ha) and K (98.52 kg/ha) respectively was recorded in treatment combination Gamhar with Pigeon pea, whereas, maximum phosphorous content was recorded in treatment combination of Gamhar with cowpea. Among all the treatments, higher net return was calculated in treatment combination Gamhar + Greengram-Mustard (76305Rs) whereas, minimum net return was in Sole Gamhar (5232 Rs). Similarly, in term of B:C ratio, it was found maximum in sole Gamhar (6.30) followed by Sole Pigeonpea (2.05). Minimum B:C ratio was found in sole Cowpea-Mustard (0.52)

Performance of Fodder crops with Bakain (*Melia azedarach*) Tree Species under Silvi-Pastoral System

Height increment after four years of experimentation revealed that Bakain recorded maximum height growth increment with fodder species *Arachis glabrata* (1.43 m) followed by height growth increment of Bakain with stylo (1.25 m), whereas, minimum height increment in Bakain was observed in treatment combination Bakain with fodder species *Bracharia mutica* (0.52 m). Maximum DBH increment in Bakain was observed with fodder species *Arachis glabrata* (3.25 cm) and minimum DBH increment was observed in Bakain with fodder species *Brachiaria*

mutica (0.78 cm). Data on fodder yield revealed that Bakain + *Brachiaria* grass yielded maximum (851.84 q/ha) fodder, whereas Sole Charabadam grass yielded 685.84 q/ha. Whereas minimum fodder yield was recorded in sole Stylo ie. 354.67 q/ha. After four years of tree plantation under Silvipastoral system, Bakain recorded significantly maximum organic carbon content (0.37%) and available nitrogen (200.84 kg/ha) in treatment combination of Bakain + fodder species *Stylosanthes hamata* whereas maximum available phosphorous (15.81kg/ha) and potassium (72.02kg/ha) was recorded in sole *Brachiaria mutica* and Bakain + *Arachis glabrata*. Significantly minimum soil pH, OC% N, P_2O_5 and K_2O was recorded in sole Bakain (5.08), Bakain + Hybrid Napier (0.25%), (157.87 kg/ha), in Bakain + *Brachiaria mutica*, (12.95 kg/ha) in Bakain + Hybrid Napier and (48.86 kg/ha) in sole *Brachiaria mutica*, respectively. Higher net return and B:C ratio was found in sole Charabadam (259336 Rs and 17.29) followed by Bakain + Charabadam (154618 Rs and 9.98) and minimum was found in Sole Bakain (80 Rs and 0.16) respectively.

Performance of field crops in Alley of Tephrosia

Blackgram equivalent yield (q/ha) was calculated for all the four crops *viz*, Soybean, Finger millet, Groundnut and Green gram. Significantly groundnut (var. BG-3) recorded maximum equivalent yield (20.98 q/ha) in treatment combination *Tephrosia* + Groundnut and minimum grain yield (5.10 q/ha) was recorded in green gram (var. Pusa Vishal) in treatment *Tephrosia* + Greengram. After four years of establishment of *Tephrosia* hedgerow under Alley cropping based Agri-silviculture system, revealed that significantly maximum soil pH (5.64) and available potassium (134.83 kg/ha) was recorded in treatment combination in *Tephrosia* + Finger millet. Whereas, maximum organic carbon (0.49%) and phosphorous content (14.63 kg/ha) was recorded in treatment combination *Tephrosia* + Soybean. Maximum nitrogen content was recorded in treatment combination *Tephrosia* + Ground nut. Net return and B:C ratio were found higher in treatment combination *Tephrosia* + Finger millet- Field pea (188910 ₹ and 4.29) followed by *Tephrosia* + Groundnut- Lentil (125245 Rs and 2.66) and minimum net return and B:C ratio was found in *Tephrosia* + Black gram-Mustard (54198 Rs and 1.20).

CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR

i) Tree Improvement

Progenies of 18 CPTs of *Melia composita* exhibited significant variability w.r.t growth characters in the field. At the age of six years after plantation, plus tree progeny MCB2 from Haryana exhibited highest diameter at breast height followed by MCPAU1 and MCS6 from Punjab and Himachal Pradesh, respectively.

Fourteen clones from YSPUH&F Solan observed for growth performance in field as multi-location trial. At the age of 7 years, dbh being the most prominent criteria in tree growth was recorded maximum (27.8 cm) in 9607 followed by 1007. Among different clones under study, clones 9607, 1007, 6503, L-200/86, G-48 and 5503 showed higher dbh indicating that these clones have lot of potential to produce utmost biomass in semi-arid regions and can be exploited in subsequent improvement programmes.

Coordinated trial of shisham with eight clones showed significant variability for growth traits. At the age of five years after plantation, the plant height differed significantly and ranged from 11.3 to 13.4 m with the general mean of 12.5 m. The highest basal diameter (14.5 cm) was observed in clone in PS-38 closely followed by L-5 and L-1 and lowest (11.5 cm) in PS-54.

ii) System research

After 5 years of age, poplar planted at 8×3 m attained significantly higher dbh (23.9 cm) than other spacings (7×3, 6×3, 5×3, 4×3 and 3×3 m) and it was about 22 per cent higher than closer spacing (3×3 m). After 5 years of age, maximum grain yield (4.32 t/ha) was recorded in wheat variety HD-2967 closely followed by WH-711 (4.21 t/ha) in wider spacing (8 ×3m) of poplar. On an average, the reduction in grain yield of different wheat varieties under poplar varied from 4.32 (8×3m) to 25.23 per cent (3×3m) over control (sole wheat).

The maximum green fodder yield of berseem (36.9 t/ha) and sorghum (33.5 t/ha) was found under 8×3 m spacing of poplar plantation however, overall reduction of 17.7% and 32.2% in green fodder yield of berseem and sorghum, respectively under different spacing was recorded over control.

- In national trial of eucalyptus planted (Oct 30, 2016) at 8×2 m spacing, the reduction in yield of mustard, wheat and berseem was 28.2, 20.0 and 16.4 per cent, respectively over control (sole crop).
- Kinnow fruit yield varied from 3.5 in agri-silvi-horti (agri. crop+ eucalypts + kinnow) to 5.0 t/ha in agri-horti (agri, crop+ kinnow) system. Significantly higher kinnow fruit weight, juice content and peel weight were found in agri- horti system however, total soluble sugar (TSS) in juice was found higher (5.77%) in agri-silvi-horti than agri- horti (5.19%) system.

- Maximum grain and straw yield of wheat was found in the interspaces of clone-83 followed by C-7. The average reduction in grain and straw yield of wheat under eucalypts (planted in February, 2015 at 7×3 m) was 30.3 and 30.8 per cent, respectively over control (devoid of trees).
- Seven years old poplar and eucalypts planted on field bunds exhibited significant reduction up to 6 m in fodder yield of sorghum and up to 3 m in grain yield of wheat from tree line. On an average, the maximum green fodder yield of sorghum and grain yield of wheat (31.4 and 3.41 t/ha) was recorded in north-south row direction of poplar bund plantation.

SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, RRS, FATEHPUR SHEKHAWATI

i) Survey, Diagnostic and Design

This year survey was undertaken in some area of Sikar and Jhunjhunu and seeds from selected trees of *Capparis decidua* and *P. cineraria* were collected and sown in nursery for evaluation. The area is covered with sand dunes and inter-dunal sandy plains. Drainage is not well developed and streams which flow in the rainy season disappear in sandy fields after covering some distance. Irrigation is restricted to areas with good ground-water potential. Pearlmillet, Sesamum and Kharif pulses are the main crops of the *Kharif* seasons. Wheat, barley, mustered and gram are grown as irrigated crops in rabi. During the survey *Capparis decidua* pocket have been identified and their biometric observations and GPS location were recorded.

ii) Tree Germplasm collection, evaluation and improvement

From year 2014-15 station is working only on Khejri (*Prosopis cineraria*) tree and total 13 provenances of *P. cineraria* (Gujarat), 15 plus tree germplasm and six location source germplasm collection of Rajasthan *viz*., Bikaner, Jhujhunu, Churu, Sikar, Jaipur, Nagaur and one from Haryana available with the centre.

Growth performance of different provenances of *P. cineraria* (Rajasthan) and (Gujarat) result revealed that the Raj 6 is performing better than other provenances in mean tree height (0.75 m) and mean collar diameter (1.5 cm) after 5 years of growth. Growth performance of 19 years old *Prosopis cineraria* PGC-2 (Bhuj) was performing better with mean tree height 2.9 m and mean dbh 10.20 cm than other provenances of Gujarat. Growth performance of 17 years old plus trees of *P. cineraria* result revealed that maximum tree height and dbh registered for PCF 15, 4.20 m and 11.0 cm, respectively.

iii) System Research

As per the QRT recommendation nursery unit has been set up for evaluation of tree seedlings growth and development of quality planting material of different tree species of the regions. This year total 3000 seedling of different tree species developed at station *viz*., *Prosopis cineraria, Azadirachta indica, Tecomella undulata, Ailanthus excelsa*, *Capparis decidua* and *Colophospermum mopane* etc.

Effect of potting mixtures on germination, growth and survival of *Ailanthus excelsa* experiment the shoot length of *Ailanthus excelsa* was significantly influenced by potting mixture and maximum shoot length was recorded in the soil: vermi (50:50) potting mixture followed by 100% soil at 90 and 120 days after sowing of seeds. The number of leaves per plant and survival percentage was significantly affected by different growing media and highest, number of leaves per plant and maximum survival percentage were observed in the soil: vermi (50:50) followed by 100% soil potting mixture.

Effect of different growing media on germination, growth and survival of *Tecomella undulata* seedlings the germination percentage and survival percentage were significantly influenced by different growing media and maximum germination percentage was recorded 41.22% and 77.97% in 1: 3: 3 and 1: 2: 0 growing media ratio (Soil: Sand: FYM) after 5 and 15 days of seed sowing. Highest

survival percentage was observed in 1: 2: 2 ratio growing media *viz*. 64.40, 59.32 and 51.73% after 90, 120 and 150 days of seed sowing. Highest number of leaves per plant and shoot length recorded in 1: 2: 2 growing media (Soil: Sand: FYM).

Effect of potting mixtures on germination, growth and survival of *Capparis decidua* experiment germination percentage was significantly influenced by potting mixtures and maximum germination was observed 75.19% after 15 days of seed sowing in coco peat:vermiculite: perlite (3:1:1). Highest plant percentage was recorded in 50:50 (Soil: Vermicompost) potting mixture 70.14, 68.73 and 65.05% after 90, 180 and 270 days of seed sowing respectively. Shoot length and root length of *Capparis decidua* was significantly influenced by different potting mixtures and the maximum shoot length and root length were recorded in the soil: vermi (50:50) potting mixture followed by 100% soil at 90, 180 and 270 days after sowing of seeds.

Performance of *H. binata* in different spacing the tree height was significantly highest (9.2 m) at narrow spacing (3x5 m^2) followed by spacing of 5x5 m^2 (8.8 m) and 4x5 m^2 (8.5 m). However, the diameter at breast height (dbh) was significantly highest at 5x5 m^2 spacing (23.0 cm) followed by wider spacing 6x5 m^2 (21.4 m), 7x5 m^2 (21.1 m) and 8x5 m^2 (20.2 m). The maximum tree volume 0.37 m^3/tree was recorded at 5x5 m^2 spacing and lowest (0.18 m^3/tree) at 3x5 m^2 spacing after 30 years of growth.

Effect of irrigation scheduling and mulching on establishment of budded Khejri (*Prosopis cineraria*) orchard the plant height, number of branches/plants, survival percentage and root collar diameter was found non-significant in first year due to extreme low temperature in winter months and slow growth of plant.

In common experiment *A. excelsa* based agri-silviculture system under rainfed conditions the average height and collar diameter registered in the range of 3.0 m to 0.5 m and 3.0 cm to 15.0 cm, respectively after 4 years of growth. Initial soil status N, P, K and organic carbon registered 130 kg/ha, 37 kg/ha, 630 kg/ha and 0.24%, respectively.

Under rainfed condition 33 years old P. *cineraria* based agri-silviculture system yield was recorded higher in all the *Kharif* crops (Pearl millet, Cluster bean, Cowpea, Green gram and Moth bean) in comparison to sole cropping system and highest increased observed in Cluster bean (23%) followed by Pearl millet (21%) and Cowpea (21%).

In rainfed condition 15 years old *H. binata* based agrisilviculture system yield was observed low (10-32%) in comparison to sole cropping system in all the *Kharif* crops (Pearl millet, Cluster bean, Cowpea, Green gram and Moth bean) without pruned tree condition.

Long term effect of different agro-forestry systems on dynamics of physicochemical properties of soil result reveled that soil pH under agro forestry systems was declined significantly and lowest pH was recorded in *Acacia tortilis* base AF system i.e 7.41, 7.65 and 7.77 as compared to open field 8.92, 8.85 and 8.80 at the depth of 0-15 cm, 15-30cm and 30-45 cm respectively. However, a significant improvement in organic carbon content was found in *Prosopis cineraria* base agroforestry system *i.e.* 0.45, 0.24 and 0.21% as compared to control 0.1, 0.07 and 0.07%.

In the experiment the effect of different agroforestry systems on biomass and carbon stock in seven Agroforestry systems. The highest soil organic carbon stock was recorded in *Tecomella undulata + Cenchrus ciliaris* based Silvi Pasture system *i.e.*, 23.90 Ton per ha followed by *Acacia tortilis* based forestry system *i.e.*, 21.34 ton /ha. The Highest Carbon stock recorded in *Cenchrus ciliaris +Nutans* based Silvi pasture System *i.e.*, 2.10 ton /ha followed by *Tecomella undulata + Cenchrus ciliaris* based agro-forestry system.

SARDAR KRUSHINAGAR-DANTIWADA AGRICULTURAL UNIVERSITY, SARDARKRUSHINAGAR

i) Survey, diagnostic and design: Nil

ii) Tree germplasm collection, evaluation and improvement:

Sr.No.	Name of experiment	Number of Entries tested	Promising entries
1	Collection and evaluation of multipurpose tree species (MPTS) in old arboretum	18	*Ailanthus excels* *Hardwickia binata*
	Collection, maintenance and evaluation of MPTS in new arboretum	33	*Ailanthus excels* Eucalyptus
2	Collection and evaluation of plus trees and provenances of neem (*Azadirachta indica*).	10 plus tree progenies + 17 provenances	SKN-3 and SKN - 7 (Progenies) Bharuch and Godhara (provenance)
3	Evaluation of plus tree progenies of neem under rainfed condition	30	Progeny No. 14 and 16
4	Evaluation of elite progenies of neem (*Azadirachta indica*)	10 + local	Elite progeny 140,110 and 118

5	Collection and evaluation of provenance of Ardusa (*Alianthus excelsa*) in light texture soil.	30	Mithivavdi Soneripura
6	Evaluation of Melia genotypes in arid and semi-arid region of Gujarat	12	SDAUMD-11
7	Evaluation of drumstick (*Moringa oleifera*) genotypes in arid and semi-arid region of Gujarat	10	PKM-1

iii) System Research:

Sr.No	Title	Salient Achievements
1	Evaluations of Melia varieties under agroforestry system for biomass production under North Gujarat conditions.	• MD 01 had highest height • MD 05 had highest collar girth and canopy • Highest greengram yield under local variety
2	Productivity of annual crops under boundary plantation based Agroforestry system.	• Greengram-mustard sequence is better • Middle part yield is more • South side tree plantation growth is more
3	Integrated Nutrient Management in ardusa (*Alianthus excelsa* L.) based agroforestry system under drip irrigation.	• Results NS but • Application of 3 kg FYM/plant + 1.5 kg Vermi./ plant+ 25 g Azospirillum is better
4	Growth and biomass production of Ardusa (*Ailanthus excelsa*) with medicinal plants based agroforestry system under irrigated conditions.	• Ardusa + isabgol intercropping was better
5	Study on *Melia dubia* legume crop based agrisilviculture system under North Gujarat conditions.	• Melia + blackgram gave maximum yield
6	Growth and Biomass productivity of *Melia azedarach* in different densities in agroforestry system	• Higher height at 5 X 1 m spacing • Higher castor yield under 5 x 5 m spacing • Higher girth at 5 X 4 m spacing

MAHATAMA PHULE KRISHI VIDYAPEETH, RAHURI

i) Collection, evaluation and maintenance of germplasm

Among all the germplasm evaluated for various characters, *Khaya grandiflora* recorded highest plant height (24.20 m), collar diameter (57.15 cm), DBH (47.56 cm) and bole height (11.10 m) followed by *Anogeissus latifolia, Acacia tortilis* and *Terminalia bellerica* were also found promising for the growth characters.

Progeny of RHRAN-1 provenance recorded significantly highest plant height (13.40 m), collar diameter (38.81 cm), DBH (33.41 cm) and bole height (3.61 m) at the age of the Nineteenth year over rest of the provenances.

The entry Sel-117 recorded significantly highest plant height (8.54 m), collar diameter (30.48 cm) and DBH (21.42 cm) whereas, local entry recorded highest bole height (3.05 m) among the various genotypes.

The *Acacia nilotica* provenance RHRAN-36 recorded significantly highest plant height (10.35 m) but at par with all the entries studied. The entry RHRAN-57 recorded significantly highest collar diameter (28.85 cm) and DBH (23.56 cm) but at par with all the entries. The entry RHRAN-6 recorded significantly highest bole height (3.51 m) whereas the entry RHRAN-41 recorded highest number of branches (6.78).

During ninth year of second coppice, the entry SRY-16 recorded significantly highest plant height (15.84 m), collar diameter (16.20 cm) and DBH (17.40 cm) over all the entries. Among the coppice of different eucalyptus clones, SRY-6 recorded significantly highest no. of coppice (3.23) but at par with all the entries studied.

ii) System Research

In the total Agro-Horti system highest gross, net monetary returns and B:C ratio (Rs, 19887, 109113) and 2.2 respectively was obtained in the treatment T7 (Mango + Aonla (Rabi. Chickpea + Kharif. Soybean).

In the experiment entitled "Effect of planting geometry on productivity of Teak under Agroforestry system in semi-arid condition the growth parameters *viz*., plant height, collar diameter, crown spread (East, West) and (North, South) of teak plants. Table, ranged from (409 to 523,8.41 to 10.72, 182 to 245, 121 to 157 cm) respectively.

The Pulses- fodder system economics based on cowpea equivalent yield (kharif and Rabi) The higher productivity qh-1 was obtained in treatment T9 and T2. (26.24 &26.02 qha^{-1}). Significantly highest GMR, NMR was obtained in treatment T8 (Sole crop cowpea – fodder sorghum) Rs, 113620,43620 B:C ratio 1.60.

DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, COA, NAGPUR

i) Survey, Diagnostic and Design

Design and Diagnostic survey of Washim district was carried out.

ii) Tree Improvement

In an experiment on the evaluation of performance of different tree species it was observed that *Ailanthus excelsa* is performing better in respect of girth (116.43 cm), height (14.00 Mt), wood volume (1.186 cum/tree) and wood volume 474.45 cm/ha^{-1}, aboveground biomass (227.73 ton/ha), and total carbon sequestration (143.47 ton/ha) in comparison to different tree species. Highest grain and straw yield of cow pea were recorded under *Ailanthus excelsa* (4.72 and 9.21 q/ha). Highest grain and straw yield of mustard in rabbi were recorded under *Ailanthus excelsa* (7.85 and 14.95 q/ha).

In an experiment on growth and productivity of tree species under citrus based agroforestry system it was observed that in *kharif* the highest grain yield of cowpea (5.00 q/ha) and straw yield (9.85 q/ha) and in *rabi* highest intercrops grain yield (9.90 q/ha) and straw yield (19.71 q/ha) was observed in mustard under sole cropping. Mandarin shows better morphological characteristics *i.e.*, height (2.85 Mt) and collar (7.16 cm) under the treatment sole mandarin. Highest tree height (14.75 Mt), GBH (65.33cm), wood volume (0.393 cum) and wood volume (109 cum/ha). Total biomass and carbon sequestration were recorded highest under Citrus + *Eucalyptus tereticornis* agroforestry system.

In an experiment on effect of fertilizers on growth and yield of Bamboo *B. balcooa* – (Bhima) under field condition, it was observed that *Bamboosa balcooa* has attained highest growth parameters (height, base dia, culm dia number of branches, number of internodes, intermodal distance) in treatment T_4 *i.e.*, 100:25:75 gm NPK clump^{-1}. Highest number of culms (7.75) was recorded in treatment T_5 *i.e.*, 125:30:100 gm of NPK clump^{-1}. Highest bamboo biomass yield (44.89 t ha^{-1}) and carbon sequestration (31.09 t ha^{-1}) was recorded under the same treatment T5 i.e125:30:100 gm NPK clump^{-1}

ii) System Research:

Agroforestry system developed on the basis of allotted MPTS

Performance and evaluation of different tree species under Agri-Silviculture system.

It was observed that among three tree species the *Ailanthus excelsa* is performing better in respect of girth (116.43 cm), height (14.00 Mt), wood volume (1.186 cum/tree) and wood volume 474.45 cm/ha^{-1}, aboveground biomass (227.73 ton/ha), and total carbon sequestration (143.47 ton/ha) in comparison to different tree species. Highest grain and straw yield of cow pea were recorded under *Ailanthus excelsa* (4.72 and 9.21 q/ha). Highest grain and straw yield of mustard in *rabi* were recorded under *Ailanthus excelsa* (7.85 and 14.95 q/ha).

Growth and Productivity of trees species under citrus based Agroforestry System

It was observed that in *kharif* the highest grain yield of cowpea (5.00 q/ha) and straw yield (9.85 q/ha) and in *rabi* highest intercrops grain yield (9.90 q/ha) and straw yield (19.71 q/ha) was observed in mustard under sole cropping. Mandarin shows better morphological characteristics i.e., height (2.85 Mt) and collar (7.16 cm) under the treatment sole mandarin. Highest tree height (14.75 Mt), GBH (65.33cm), wood volume (0.393 cum) and wood volume (109 cum/ha). Total biomass and carbon sequestration were recorded highest under Citrus + *Eucalyptus tereticornis* agroforestry system.

Effect of planting geometry of teak under Agroforestry system in semi-arid condition.

Among the different treatment under paired row teak plantation, it was observed that the highest height (5.07 Mt) and collar diameter(8.40cm) of teak was recorded in treatment T4 i.e., Teak (Paired row) 8 x 2x 2 m + Black Gram-Fodder sorghum. Highest grain yield (7.91 q ha^{-1}) and highest straw yield (16.95 q ha^{-1}) was recorded in Treatment T9 Sole black gram-Fodder Barseem. During *rabi* season highest fodder yield (523.20 q ha$^{-1)}$ was recorded in sole black gram+ Barseem sequence.

Germplasm collection & evaluation of commercial bamboo species.

Among the newly planted (2020)) of bamboo germplasm significantly highest culm height (8.83 Mt), base diameter of culm (44.33 mm), culm diameter (39.67 mm) and no. of internode culm^{-1} was recorded in *Thyrsostachys oliveri* as compared to other bamboo species. Maximum number of new culm clump^{-1} (10.67), total number of culm (23.67) was reported in *Oxtenanthera parvifolia.* Highest weight of clump (65 kg), yield of bamboo (40.63 t ha^{-1}), aboveground biomass (44.69 t ha^{-1}), belowground biomass (11.62 t ha^{-1}), total biomass (56.31 t ha^{-1}), above ground carbon sequestration (22.34 t ha^{-1}), below ground carbon sequestration (5.81 t ha^{-1}) and total carbon sequestration (28.15 t ha^{-1}) was recorded by *Oxtenanthera parvifolia* followed by *Dendrocalamus asper, Bambusa pallida and Thyrsostachys oliveri.*

Among the old bamboo germplasm (2015) significantly highest culm height (11.50 m) was recorded in *Bambusa tulda.* Highest base diameter of culm (71.67 mm), Highest culm diameter (67 mm) was recorded in *Bambusa nutan.*

Highest internode distance (27 cm) was noticed in *Bambusa vulgaris (yellow)* followed by *Dendrocalamus stockssi (26.33 cm).* It was also observed that among bamboo species highest number of new culm clump $^{-1}$ (18.33), total number of culm (40.00) and clump area (134.33 cm^2) was reported in *Dendrocalamus stockssi* followed by *Bambusa bambus (Katang).* Maximum weight of clump (195 kg), yield of bamboo (121.88 t ha^{-1}), aboveground biomass (134.06 t ha^{-1}), belowground biomass (34.86 t ha^{-1}), total standing biomass (168.921 t ha^{-1}), above ground carbon sequestration (67.03 t ha^{-1}), below ground carbon sequestration (17.43 tha^{-1}) and total carbon sequestration (84.46 tha^{-1}) was recorded by *Dendrocalmu stockssi* followed by *Bambusa balcooa* and *Bambusa tulda.*

Germplasm collection and evaluation of Maharukh *(Ailanthus excels).*

From the study it was concluded that in 11-year evaluation of progeny of Maharukh (*Ailanthus excelsa) accession no.* ACN/MHK/1 was found to produce highest woody Biomass (158.33-ton ha^{-1}), highest wood volume (156.70 m^3 ha^{-1}), highest monetary return (Rs. 1229703 ha^{-1}), highest carbon sequestration (39.17 t ha^{-1}), and highest B/C ratio (4.93). Hence for improving the raw material supply to wood-based industries, plantation of Maharukh (*Ailanthus excelsa)* ACN/MHK/1 progeny is advised under agroforestry.

Studies on growth and productivity of bamboo under Agrisilviculture system in shallow- medium soil.

From the study it was concluded that three species of bamboo namely *Bamboosa balcooa* (Bhima), *Dendrocalamus stocksii* (Manga) and *Dendrocalamus strictus* (Manvel) were planted at 8 X 4 m spacings under agroforestry system. Cowpea was grown in *kharif* season. Higher bamboo biomass production (77.80 t ha^{-1}), higher net monetary returns (Rs. 300151/ ha^{-1}) and higher benefit cost ratio (3.50) were recorded under the treatment T5–*Bamboosa balcooa* (Bhima)+ Cowpea +125% more RDF (25: 50: 0).

Clonal Evaluation of *Melia dubia* under in semiarid conditions.

Among the different *Melia dubia* clone, highest height (10.00 m) and GBH (58.67 cm) were recorded in PDKV/MTP/6, respectively, Maximum wood volume (0.215 m^3), wood volume ha^{-1} (86.04 m^3 ha^{-1}), aboveground biomass (35.99 t ha^{-1}), belowground biomass (9.36 t ha^{-1}), total biomass (45.35 t ha^{-1}), above ground carbon sequestration (18.00 t ha^{-1}), belowground carbon sequestration (4.68 t ha^{-1}) and total carbon sequestration (22.68)t ha^{-1} was recorded by *Melia dubia* clone PDKV/MTP/6 followed by PDKV/MTP/4.

Effect of fertilizers on growth and yield of Bamboo (*B. balcooa* – Bhima) under field condition.

Bamboosa balcooa has attained maximum growth in treatment T4 where 100:25:75 gm NPK $clump^{-1}$ was applied. Maximum number of culms were recorded in T5 treatment i.e. 125:30:100 gm of NPK $clump^{-1}$ applied. Highest bamboo biomass yield (44.89 t ha^{-1}) and carbon sequestration (31.09 t ha^{-1}) were recorded under 125:30:100 gm NPK $clump^{-1}$.

Effect of fertilizers on growth and yield of Manga Bamboo (*D. stocksii*) under field condition.

Dendrocalamus stocksii was attained maximum growth parameter in treatment T4 where 100:25:75 gm NPK $clump^{-1}$ was applied. Maximum number of culms $clump^{-1}$ (9.88), bamboo biomass yield (29.79 t ha^{-1}) and carbon sequestration (20.64 t ha^{-1}) was recorded in T4 treatment where.100:25:75 gm of NPK $clump^{-1}$ was applied.

Effect of Potting mixture on growth & development of quality planting material of *B. balcooa (Bhima)*

It was revealed that among the different potting mixture, better growth and morphological characteristics of *Bambusa balcooa* saplings highest height (93.75 cm), branches /tiller (3.25) were observed under potting mixture of Garden soil + FYM in 1:1 ratio.

Effect of Growth hormones on growth and development of quality planting material of *Bamboosa balcooa*

It was revealed that amongst the different growth regulator treatments, better growth and morphological characteristics of *Bamboosa balcooa* sapling highest height (48cm), base diameter (6.40 mm) was observed in treatment T1 (Main culm + IBA 1500 PPM) and T2 (Main culm + IBA 2000 PPM).

JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA, JABALPUR

i) Tree Improvement

In provenance trial of Shisham (*Dalbergia sissoo*) seeds/seedling of seven provenances collected from different places [(*viz*; Jhansi (02), Faizabad (01), Nagpur (01), Raipur (1), Samastipur, Bihar (1) and Jabalpur (01)], were collected, and planted in the field under RBD design replicated thrice, provenance collected from NRC Jhansi (T7) recorded higher plant height (1021 cm). The collar diameter (216 mm) and dbh (181mm) at the age of 11 ½ years.

ii) System Research

Agrisilviculture (*Dalbergia sissoo* + Paddy – Wheat)

- Under 23 years old agrisilviculture system (*Dalbergia sissoo* + Paddy-Wheat) where 4 pruning treatments (*viz*., without pruning, 25%, 50% and 75% pruning)

along with open were put under main plot and three weed management practices (*viz*; T1: Pendimethalin@1.0 kg a.i. ha^{-1} as PE fb hand weeding at 30DAS, T2: Pendimethalin@1.0 kg a.i. ha^{-1} as PE fb Bispyribac- sodium @ 25 g a.i. ha^{-1} for paddy, Metribuzin @230 g ha^{-1} in wheat crop], [T3: Weedy check] in sub plot.

***Dalbergia sissoo* - Rice**

Kharif

- The Significantly highest grain and straw yields of paddy were recorded under open condition (3584 and 7392 kg ha^{-1}) which was found at par with 75% pruning (3227 and 7171 kg ha^{-1}) grain & straw yields, respectively. Whereas no pruning recorded significantly lowest grain and straw yields of 2552 and 6190 kg ha^{-1} respectively.
- Among pruning intensities, significantly maximum grain yield was recorded under 75% pruning (3227 and 7171 kg ha^{-1}) at par with 50% pruning (2985 and 6810 kg ha^{-1}) and 25% pruning (2755 and 6545 kg ha^{-1}) but significantly superior to no pruning.
- The percent reduction in grain yield under no pruning, 25%, 50% and 75% pruning as compared to open condition was 28.7%, 23.1%, 16.7% and 10.0%, respectively.
- As regards to weed management, treatment T1 (Pendimethalin @ 1.0 kg a.i. ha^{-1} as PE fb hand weeding at 30 DAS) was recorded highest grain and straw yields of 3306 and 7008 kg ha^{-1} and proved at par with pendimethalin @ 1.0 kg a.i. ha^{-1} as PE fb Bispyribac-sodium@ 25 g a.i. ha^{-1} as PoE (3023 and 6848 kg ha^{-1}) respectively. The weedy check recorded significantly lowest grain and straw yields of 2732 and 6609 kg ha^{-1}, respectively.
- 25% pruning recorded significantly higher monetary return of Rs.78769 ha^{-1} and found at par with 50% pruning (Rs. 63572 ha^{-1}) but significantly superior to no pruning (Rs. 58481 ha^{-1}) and 75% pruning (Rs. 49851 ha^{-1}).
- Managed agroforestry system (*Dalbergia sissoo* +paddy) recorded higher monetary return (Rs. 64064 ha^{-1}) as compared to crop alone (Rs. 28779 ha^{-1}) and tree alone (Rs. 41048 ha^{-1}).
- Application of pendimethalin @ 1.0 kg a.i. ha^{-1} as PE fb Bispyribac-sodium @ 25 g a.i. ha^{-1} as PoE recorded significantly higher monetary return (Rs.62599 ha^{-1}) and statistically at par with the application of pendimethalin @ 1.0 kg a.i. ha^{-1} as PE (Rs.57054 ha^{-1}). Lowest monetary return was recorded under weedy plot (Rs. 48018 ha^{-1}).

***Dalbergia sissoo*-Wheat**

Rabi

- Maximum grain yield (3205 kg ha^{-1}) of wheat was recorded under open condition which was significantly superior to all the pruning treatments. No pruning recorded significantly lowest grain yield (12.41 q ha^{-1}) and proved at par with 25% pruning.
- Among different pruning treatments 75% pruning recorded significantly higher grain yield (2626 kg ha^{-1}) and proved significantly superior over 50% and 25% pruning as well as no pruning. No pruning recorded significantly lowest grain yield of 1822 kg ha^{-1} followed by 25% pruning.
- The percent reduction in yield under no pruning, 25%, 50% and 75% pruning as compared to open was 43.1, 37.5, 26.6 and 18.07 percent respectively
- In *Dalbergia sissoo* + wheat crop based agrisilviculture system, 25% pruning recorded significantly higher monetary return of Rs.74466/ha which was at par with 61108 and Rs. 56491/ ha recorded under 50% and no pruning, respectively but significantly superior to 75% pruning (Rs.48915/ ha).
- Under managed agroforestry system (*Dalbergia sissoo*+ wheat) recorded significantly higher monetary return (Rs.61496/ha) than unmanaged agroforestry system i.e., no pruning (Rs.56491/ha). Under managed agroforestry system wheat+ Dalbergia sissoo in 25% gave significantly higher monetary return (Rs.74466/ha) than growing of crop alone (Rs.32506 / ha).
- Application of pendimethalin @ 1.0 kg ha^{-1} as PE fb metribuzin recorded higher monetary return (Rs 62566 ha^{-1}) and found at par with T1 i.e., pendimethalin @ 1.0 kg ha^{-1} as PE fb hand weeding at 30 DAS (Rs. 56034 ha^{-1}) and was significantly superior to weedy check (Rs. 45492 ha^{-1}).
- Under managed agroforestry system, Paddy-wheat + *Dalbergia sissoo* in 25% pruning gave higher monetary return (Rs. 87495 ha^{-1}/year) as compared to growing of crop alone (Rs. 61285 ha^{-1}/year) and tree alone (Rs. 41048 ha^{-1}/year)
- Application of Pendimethalin @ 1.0 kg ha^{-1} as PE fb bis-pyribac sodium @ 25 g ha^{-1}/ metribuzin @ 230 g ha^{-1} as PoE recorded higher monetary return (Rs 81808 ha^{-1}) and found at par with T1 i.e., pendimethalin @ 1.0 kg ha^{-1} as PE fb hand weeding at 30 DAS (Rs. 75107 ha^{-1}) and was significantly superior to weedy check (Rs. 60201 ha^{-1})

Agrisilviculture system (*Dalbergia sissoo* + Mustard crop)

- Under 23 years old agrisilviculture system (*Dalbergia sissoo* + Mustard) in which 4 pruning treatments (*viz*., no pruning, 25%, 50% and 75% pruning) and one open were put under main plot and three levels of fertilizer doses in mustard crop during *rabi* season (*viz*; F1- 100% RDF through fertilizer, F2- 125% RDF through fertilizer, F3- 75% RDF through fertilizer) in sub plots.
- Significant highest seed yield of mustard was recorded under open condition (747.9 kg ha^{-1}) and proved superior to pruning treatments.
- Among different pruning intensities, 75% pruning recorded significantly higher seed yield of 610.73 kg ha^{-1} and it was at par with 50% and 25% pruning. However, both were significantly superior to no pruning which recorded the lowest grain yield (495.87 kg ha^{-1}).
- The percent reduction in seed yield under no pruning, 25%, 50% and 75% pruning as compared to open condition were 33.69, 27.47, 22.99 and 18.34%, respectively.
- 125% RDF recorded significantly highest seed yield of 633.73 kg ha^{-1} which was at par with 100% RDF but significantly superior to 75% RDF and recorded 561.5 kg ha^{-1} seed yield.
- The percent increase in yield under T2 (125% RDF) over T3 was 7.10 and 11.39% respectively
- The significantly higher NMR of Rs. 81011 ha^{-1} was computed under 25% pruning which was significantly superior over 75% pruning and at par to 50% and no pruning.
- 125% fertility level recorded higher NMR of Rs. 66033 ha^{-1}. The lowest was (Rs. 58488 ha^{-1}) recorded under 100% fertility level.
- The interaction of pruning and fertility levels 50% pruning fertilized with 125% RDF fetched highest net return of Rs. 99260 ha^{-1}. While open conditions with all the three fertility levels gave lowest returns/ha.

***Gmelina arborea* based agrisivicultural system**

- *G. arborea* + greengram- mustard was recorded the highest arhar equivalent yield of 1763.4 kg ha^{-1} as compared to sole arhar yield of 1005.6 kg ha^{-1}.
- In *Gmelina arborea* based agrisilviculture system, the highest plant height (492.6 cm), collar diameter (93.58 mm) and dbh (69.30 mm) was recorded in sole *G. arborea* at the 51/2 year after planting followed by *G. arborea* + cowpea-toria and *G. arborea* + greengram-toria. The lowest plant height (348.25 cm), collar diameter (81.73 mm) and dbh (58.47 mm) was observed in *G. arborea* + arhar
- Among the *Gmelina arborea* based agrisilvicultural system, *G. arborea* + greengram-mustard was recorded the highest net return of (Rs. 67836 ha^{-1}) and B:C ratio of (2.66) as compared to sole arhar (Rs. 44323 ha^{-1}) and fetched B:C ratio of 2.65 per rupees investment.

Agrihorticulture system (Mango + kodo millet varieties)

- In mango based agrihorticulture system, among the inter crops the highest production of 694.20 and 1984.3 kg/ha of grain and straw yields were recorded mango + kodo variety JK 137 respectively whereas the alone kodo variety performed similar way as under inter crop. The significantly lowest yields of grain (630.58 kg/ha) and straw (1405.7 kg/ha) with mango+JK155 however it was at par with sole JK 155.
- In the mango based agrihorticulture system, highest net returns of Rs. 20685 was recorded under variety JK-137. The lowest net returns of Rs. 20685 was recorded under mango+ JK-137.
- In the mango based agrihorticulture system, kodo variety JK-137 was recorded highest net returns of Rs. 20685 followed by mango+JK-137 Rs. 20239/ha. The lowest monertary return of Rs. 17701 was recorded in kodo variety JK-155 under mango plantation. However, the B:C ratio did show significant change in B:C ratio.

Agrihorticulture system (Mango + linseed varieties under weed management)

- Highest seed and straw yields of 1124 and 2459 kg ha^{-1} were recorded in linseed variety JLS-66 followed by linseed variety JLS-27 (979.0 kg ha-1 and 2142 kg ha^{-1}). Linseed variety JLS-9 recorded lowest seed and straw yields of 789.0 and 1748 kg $ha^{-1,}$ respectively. It showed that variety JLS 66 performed better over JLS 27 and JLS 9 with respect to yield under agrihorticulture system.
- Hand weeding at 30 DAS recorded the highest seed and straw yields of 1135 and 2384 kg ha^{-1} found superior over application of pendimethalin @ 1000 g ha^{-1} as PE and weedy check. The weedy check recorded lowest seed and straw yields of (760 and 1748 kg ha^{-1}).
- Among mango based agrihorticulture system, linseed variety JLS-66 recorded the higher monetary returns of (Rs. 42909 ha^{-1}) followed by JLS-27 (Rs. 34922 ha^{-1}) and JLS-9 (Rs. 24460 ha^{-1}). The highest B:C Ratio of 3.26 was recorded in the top-ranking variety JLS-66.
- As regards to the weed management practices hand weeding at 30 DAS followed by pendimethalin spray as PE @ 1000 ml/ha recorded the net monetary returns of (Rs. 40175 ha^{-1} and 36567 ha^{-1}) with B:C Ratio of 3.00 and 2.81 respectively.

Agrihorticulture system (Mango + linseed varieties with sulphur)

- Under 3 years old agrihorticulture system (*Dalbergia sissoo* + linseed varieties) where 3 linseed varieties (*viz*. JLS-9, JLS-66, and JLS-73) and three levels of sulphur doses in linseed crop in *rabi* season (*viz*; S1- control, S2- 20 kg ha^{-1}, S3- 40 kg ha^{-1}) in factorial RBD.
- Highest seed and straw yields of 12.22 and 27.13 q ha^{-1} were recorded in linseed variety JLS-77 followed by linseed variety JLS-66 (10.33 q ha^{-1} and 23.13 q ha^{-1}). Linseed variety JLS-9 recorded lowest seed and straw yields of (8.24 and 18.98 q ha^{-1}) respectively.
- Application of sulphur @ 40 kg/ha recorded the highest seed and straw yields of 11.20 and 24.59 q ha^{-1} and found at par with the application of sulphur @ 20 kg/ha and significant superior over control. The control plot recorded lowest seed and straw yields of (8.98 and 21.32 q ha^{-1}), respectively.
- Linseed variety JLS-73 recorded the higher monetary returns of (Rs. 47972 ha^{-1}) found significantly superior over JLS-66 (Rs. 36936 ha^{-1}), JLS-9 (Rs. 26082 ha^{-1}). The highest B:C Ratio of 3.49 was recorded in the top-ranking variety JLS-73.
- As regards to the sulphur doses, application of sulphur @ 40 kg/ha recorded the net monetary returns of (Rs. 39362 ha^{-1}) and found at par with the application of sulphur @ 20 kg/ha (Rs. 38500 ha^{-1}). The highest B:C Ratio of 3.03 was recorded with the sulphur dose @ 40 kg/ha.

Agrisilviculture system (*Dalbergia sissoo* + different methods of mustard planting and levels of sulphur)

- Under 23 years old agrisilviculture system (*Dalbergia sissoo* + Mustard) three methods of sowing (*viz*. M1- line sowing, M2-Broadcasting, M3- SMI) were put under main plot and four levels of sulphur doses in mustard crop (*viz*: S1- control, S2- 20 kg ha^{-1}, S3- 20 kg ha^{-1}, S4- 40 kg ha^{-1}) in sub plot.
- Highest seed and straw yields of 621.17 and 1640.67 kg ha^{-1} were recorded in SMI and found significantly superior over line sowing and broadcasting. Lowest seed and straw yield of 440.88 and 1190.39 kg ha^{-1} was recorded in broadcasting.
- Application of sulphur @ 40 kg ha^{-1} recorded the significantly highest seed and straw yields of 576.89 and 1576.08 kg ha^{-1} and proved at par to application of sulphur @ 30 kg ha^{-1} and found superior over @ 20 kg ha^{-1}. Lowest seed and straw yield of 435.18 and 1198.91 kg ha^{-1} was recorded in control plot.
- Highest net monetary returns of Rs. 21212 ha^{-1} with B:C ratio of 2.17 were recorded in SMI and found significantly superior over line sowing and broadcasting. Lowest net monetary return of Rs. 12335 ha^{-1} with B:C ratio of 1.75 was recorded in broadcasting.
- Application of sulphur @ 40 kg/ha recorded the significantly maximum net monetary returns of Rs. 18167 ha^{-1} at par to application of sulphur @ 30 and 20 kg ha^{-1} and found superior over control. Minimum net monetary returns of Rs.13381 ha^{-1} was recorded in control plot.

Agrisilviculture system (*Pongamia pinnata* + Wheat varieties under different sowing dates)

- Among the system, open system showed their superiority over agrisilviculture with respect to grain and straw yields as well as harvest index and recorded the higher grain yield of 48.69 q/ha straw yield (103.46 q/ha) as well as harvest index of 32%.
- Variety GW-322 produced 46.90 and 80.01 q/ha yields of grain and straw with HI of 38.10%, respectively. Among the sowing dates, the early sowing date i.e., 12th Nov. proved statistically superior over rest of the dates for grain yield (47.54 q/ha) and HI (38.12).
- The agroforestry system sequestrated more quantity of carbon (107.34t/ha) and carbon storage (29.24 t/ha) and proved superior over open situation.
- Wheat variety GW-322 proved superior over MP-3336 with respect to carbon stock and carbon sequestration t/ha. The variety GW-322 stocks (18.19 t/ha) and carbon sequestrated 66.75 t/ha.

PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY, HYDERABAD

i) Tree Germplasm collection, evaluation and improvement

- In the trial on collection, evaluation and maintenance of Neem germplasm, Line-117 recorded higher mean plant height (8.1 m) followed by Line-118 (8.0 m). Similarly, line-115 has recorded second highest plant height (8.1 m) and mean girth (81 m). The fruiting score was higher in 115 and 117 (5 scale).
- In Pongamia germplasm, SRJ-39 recorded highest plant height (8.1 m) followed by SRJ-43 (7.8 m) SRJ-45 (7.5 m). In terms of girth, SRJ-39 recorded highest girth (70 cm) followed by NGSR-27 (68 cm) and SRJ-38 (59 cm) were found promising. The pod yield was higher in SRJ-39 (12 kg tree^{-1}), SRJ-43 (10.5 kg tree^{-1}) and SRJ-45 (10 kg tree^{-1}).
- Among the two *Melia dubia* clones, MTP-5 performed better with more height (12.9 m) and girth (58 cm) after 7 years of planting. Among the several tree species promoted and incorporated in agroforestry systems, the potential of *Melia dubia* in agroforestry is gaining significant attention. This is due to the fast-growing nature of the tree, multiple utility coupled

with its amenability for cultivation in various agro climatic zones of the country.

ii) System research

Mango based in Agri-horti system

Significantly higher maize green cob yield (10.33 t ha^{-1}) and redgram seed yield (0.939 t ha^{-1}) was recorded with 125% RDF which was on par with all treatments except T_6 75% RDN + *Azotobacter* + PSB (5 kg ha^{-1}) and T_1 - FYM 10 t ha^{-1}. In Curry leaf which was grown as filler crop, highest fresh curry leaf yield of 3.7 t ha^{-1} was obtained with T_4 75% RDN + 25% N through FYM and 75% RDN + 25% N through PM. N uptake (kg ha^{-1}) by maize grain was highest in T_2 125% RDF (59.9 kg ha^{-1}) which was at par with all other treatments except T_1 (FYM 10 t ha^{-1}) and T_6 (75% RDN + Azotobacter + PSB). P uptake (kg ha^{-1}) was also significant and showed the same trend. K uptake (kg ha^{-1}) was highest in T_4 (75% RDN + 25% N FYM) (15.0 kg ha^{-1}) and T_5 75% RDN + 25% N PM (16.0 kg ha^{-1}) which were significantly different from all other treatments. Maize equivalent yield (MEY) of maize - *rabi* redgram system was significantly higher with 125% RDF (13459 kg ha^{-1}) but was on par with 75% RDN + 25% N FYM (13095 kg ha^{-1}), sole crop without tree (13043 kg ha^{-1}), 75% RDN + 25% N FYM (12558 kg ha^{-1}) and 100% RDF (12315 kg ha^{-1}). Total net returns with maize - *rabi* redgram system was significantly higher with application of 125% RDF to both the crops (Rs. 1,54, 888 ha^{-1}) with B:C ratio (2.38) which was on par with T_5 75% RDN + 25% N PM (Rs. 1,47,423 ha^{-1}) with B:C ratio (2.18), T_4 75% RDN + 25% N FYM (Rs. 1,38,963 ha^{-1}) with B:C ratio (2.05) and 100% RDF (RS. 1,38,423 ha^{-1}) with B:C ratio 2.19. The soil analysis data shows that there was no major change in pH, EC and Nitrogen values when compared to initial values. However, significantly highest organic carbon content was observed in FYM applied plot when compared to other treatments. Lowest organic carbon observed in inorganic fertilizer applied plots. P_2O_5 and K_2O were non-significant.

- In Mango based agri horti system curry leaf and drum stick as filler crops in 8 m x 8m spacing mango plants with intercrops like maize or sorghum or redgram in *kharif* and safflower in rabi, cowpea in summer with irrigation is more economical agroforestry system up to 5 years of mango plantation. Farmer can get net income of about 50 to 60 thousand per hectare per year. Before getting income from mango. Farmer can grow inter crops for additional income and to improve the soil fertility by incorporating the intercrops after harvest into the soil.
- Among the two forage species tested, Guinea grass (*Panicum maximum)* has recorded significantly higher forage yield (21.6 t ha^{-1}) and dry forage yield (7.58 t ha^{-1}) with three cuttings when compared with Anjan grass (*Cenchrus ciliaris)* (13.96 t ha^{-1}, 4.88t ha^{-1} respectively).
- Among the nutrient management treatments, application of 75% RDN +25% N PGLM has produced higher forage yield (20.25 t ha^{-1}) which was at par with 100% RDF (60-60-40 kg NPK ha^{-1}) recorded (19.64 t ha^{-1}) followed by 75% RDN+25%N Poultry manure (18.73 t ha^{-1}) and significantly higher when compared to all other treatments.
- Crude protein (%) content was found to be significant in forage species *Panicum maximum* (9.859%) when compared to *Cenchrus ciliaris* (9.03%). Among the different nutrient management treatments, application of 75% RDN +25% PGLM has produced higher crude protein (10.3%) which was on par with all other nutrient management treatments except control (7.5%).
- Crude fiber (%) content did not differ significantly between two grass species. Among the different nutrient management treatments, application of 75% RDN + 25% PGLM has produced higher crude fiber (35.9%) which was on par with 75% RDN + 25% NGLM (32.6%) and significantly higher when compared to other nutrient management treatments.
- The gross (Rs.96,188 ha^{-1}) and net returns (Rs.55,546 ha^{-1}) were higher in *Panicum maximum* when compared to *Cenchrus ciliaris.* Among the different nutrient management treatments gross returns (Rs.1,05,805 ha^{-1}) and net returns (Rs. 64,305 ha^{-1}) recorded significantly higher in T_3 -75% RDN + 25% N through PGLM than all other treatments.
- Among the fodder species, higher B:C ratio was observed with *Panicum maximum.* (1.36). Among the nutrient management treatments, significantly higher BC ratio was observed with 75% RDN + 25% PGLM (1.55) which was at par with 100% RDF (1.42).
- N, P, K uptake was influenced by type of fodder and nutrient management practices. Significantly higher NPK uptake was recorded with guinea grass (135, 13, 176 kg ha^{-1}, respectively). Among the nutrient management treatments, application of 75% RDN + 25% Poultry manure produced higher NPK uptake (124, 12.5, 189 kg ha^{-1}, respectively) followed by 75%

RDN + 25% PGLM (135, 12.4, 185 kg ha^{-1}, respectively).

- Soil parameters were non-significant except organic carbon. Organic carbon was significant with anjan grass. Among the nutrient management treatments pH, EC and available P_2O_5, K_2O were found non-significant. OC was found highest in T_3 -75% RDN + 25% N Through PGLM which was on par with T_6 -75% RDN + 25% N Through PM and significantly different from all other treatments. Available N was highest in T_3 -75% RDN + 25% N Through PGLM which was on par with T_6 -75% RDN + 25% N Through PM, T_4 -75% RDN + 25% N Through NGLM and T_5 -75% RDN + 25% N Through SGLM and significantly different from all other treatments.
- In nutrient management of different fodder crops in custard apple based horti- pastoral system, (5yrs old trees) has revealed that custard apple fruit yield of 3.2 to 3.5 t / ha was realized along with cultivation of cereal/legume grasses. Among the grasses, *Panicum maximum* (Guinea) has produced higher mean forage yield (11.25 t ha^{-1}) with 3 cuts when compared to *Cenchrus ciliaris* (Anjan grass) (10.25 t ha), *Hedge lucerne* (2.8 t ha^{-1}). The gross returns worked out with local market prices has shown that Custard apple + guinea grass realized Rs. 75,375 ha^{-1} followed by custard apple + Anjan grass (Rs. 73375 ha^{-1}). These results are useful to small / marginal farmers for milch animals in maintaining balanced green forage production in arid region in Telangana.

DR. BALA SAHEB KONKAN KRISHI VIDYAPEETH, DAPOLI

Survey, Diagnostic and Design: Nil.

i) Tree Germplasm collection, evaluation and improvement:

Collection and conservation of *Melia dubia, Gmelina arborea*, *Bamboo species, Tectona grandis, Garcina indica, Militia pinnata, Acacia mangium, Madhuca latifolia, Anacardium occidentale,* etc.

ii) System Research:

Terminalia tomentosa residue @ 5 ton/ha is recommended for the development of soil fertility instead of "Rabbing" practices in Konkan. Bamboo (*Dendrocalamus stockssi*) + Turmeric (*Curcuma longa*), Bamboo (*Dendrocalamus stockssi*) + Finger millet (*Eleusine coracana*), Mango (*Mangifera indica*) + groundnut (*Arachis hypogea*), Cashew (*Anacardium occidentale*) + black gram (*Vigna mungo*) agroforestry systems, *Melia dubia* block plantation as a cash crop in Konkan region, these technologies are most popular in Konkan region of Maharashtra and it is recommended previously from this centre for the farmers.

TAMIL NADU AGRICULTURAL UNIVERSITY, FCRI, METTUPALAYAM

Two promising Casuarina clones have been assembled and are being evaluated

- *Toona ciliata* (TC02), a promising clone is being evaluated under Silvihorticulture system
- A promising clone in *Eucalyptus urograndis* (EU01) is being evaluated for growth traits
- Acacia hybrid is in advanced stage of evaluation
- 18 tree fodder germplasm assembled and are being evaluated for their potential in fodder pellet production
- Multifunctional Agroforestry model (Circular model) has been established and is being evaluated for ecosystem services

TAMIL NADU VETERINARY AND ANIMAL SCIENCES UNIVERSITY, IAN, KATTUPAKKAM

System research

Studies in hortipasture system

Application of organic nutrients (biogas slurry + 3% foliar spray of Panchagavya) in hortipasture system will enhance the yield of coconut and also the sustainability of the *Desmanthus virgatus* odder in the system. *Cocos nucifera*

based hortipastoral system sequestered the highest carbon (73.41 t/ha) followed by *Psidium guajava* based hortipastoral system with 42.45 C t/ha. This result is due to higher carbon storage by understorey crops especially multicut fodder crops as compared to annual fodder crops in the system. Among different in situ moisture conservation measures practiced hortipasture, it is observed that treatment, mulching with coconut husk (T2) is superior to others in conserving the soil moisture *in situ*. *Cenchrus ciliaris* and *Stylosanthes hamata* 3:1 ratio (T5) recorded the highest Cenchrus equivalent green fodder yield. Higher carrying capacity of 49 and 61 numbers of sheep ha^{-1} was obtained during 2020-21 and 2021-22 respectively. Results indicate *that Cenchrus ciliaris* and *Stylosanthes hamata* 3:1 ratio-based grass-legume intercropping system is the best system for enhanced fodder production under hortipasture based agroforestry system.

The findings of the feeding trial in Aseel layers with *Desmanthus virgatus* leaf meal obtained in hortipasture system is summarized as follows - Hen Housed Egg Production in control, treatment 1 and treatment 2 were 44.89%, 48.22% and 45.94% respectively. Hen Day Egg Production in control, treatment 1 and treatment 2 were 47.26%, 50.69% and 48.61% respectively. The mean egg weight in control, treatment 1 and treatment 2 were 50.75±1.16 g, 50.25±1.41 g and 46.37±1.03 g respectively. The yolk colour in the control, treatment 1 and treatment 2 was 8.37±0.32, 8.50±0.19 and 8.12±0.52 respectively. The beta carotene content of eggs of the control, treatment 1 and treatment 2 was 1.86±0.07 mg/kg, 4.31±0.41 mg/kg and 4.19±0.54 mg/kg respectively. The linolenic fatty acid (Omega-3) content of the control, treatment 1 and treatment 2 was 0.19±0.06%, 0.43±0.21% and 0.26±0.13% respectively. Hence, 5% *Desmanthus virgatus* leaf meal incorporated in concentrate feed improved the egg production performance and composition of egg compared to the control feed.

Studies in silvipasture system

The total biomass of fourteen-year-old *Gliricidia sepium* was calculated as 98.4 t ha^{-1}, and a single tree accounts about 0.062 t biomass. A total of 45.65 t C ha^{-1} was stored in the thirteen-year-old *Gliricidia sepium*. A total of 90.53% carbon was allocated in the aboveground components whereas only 9.35% carbon was allocated in the belowground components of the trees. Average annual increase in carbon sequestration potential of silvipasture in degraded lands was 3.94 t/ha. *Gliricidia sepium* with the understorey of *Stylosanthes scabra* based silvipastoral system show significant soil carbon, indicating the potential for carbon sequestration.

Among different in-situ soil moisture conservation treatments, Gliricidia leaf mulch (T3) was the best among in-situ soil moisture conserving techniques. Storing the rainwater through the application of Gliricidia leaf mulch under degraded wasteland, sustains production of tree fodder and pasture yield in silvipasture system.

UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD

i) Design and Diagnostic Survey

AICRP on Agroforestry, UAS, Dharwad had undertaken the design and diagnostic survey for the perennial components which are more prominent among the farming community. In Northern Dry Zone, *Azadirachta indica*, *Hardwickia binata, Prosopis cineraria, Acacia nilotica, Santalum album, Pterocarpus santalinus* etc, are common tree species while the other timber tree/fruit species *viz.,* Teak, Malabar neem, Mango, Pomegranate, Papaya, Grapes etc are dominant in the irrigated ecosystem. In the Transitional Zone, the predominant perennial components are Teak, Mango, Sapota, Guava, Curry leaf, Jack and Jamun etc. However, Teak is planted on the bunds/ channels. *Melia dubia* is being cultivated in the recent past on large scales. In Hill Zone, the multistoried agroforestry systems are noticed in farmer's field where Arecanut, *Erythrina indica*, Jack, Cardamom, Jamun etc., were common species observed. The paddy is main field crop grown in lowlands. *Casuarina equisetifolia* and *Grevillea robusta* are mainly grown as wind breaks in these areas.

ii) Tree Germplasm Collection, Evaluation and Improvement

The AICRP on Agroforestry, UAS, Dharwad centre is allotted with some mandate tree species *viz. Azadirachta indica, Tamarindus indica*, *Pongamia pinnata, Melia dubia, Emblica officinalis, Carissa carandas* and thornless bamboo species for evaluation of germplasm.

Among the twenty provenances of the neem species collected, the maximum volume was recorded in Bijapur (0.983 m^3/tree) and Raichur (0.905 m^3/tree) provenances

when compared to other provenances. Similarly, the highest neem seed yield was also registered in Bijapur (6.25 kg/tree) and Raichur provenances (5.50 kg/tree) compared to other provenances.

Among the fourteen tamarind collections *viz.,* NTI–5, NTI-14, NTI-15, NTI-19, NTI-31, NTI-32, NTI-77, NTI – 79, NTI-80, NTI-84, SMG-4, SMG-13, TKA-1, PKM-1 evaluated, the growth parameters were significantly higher among NTI-5 (9.90 m) and NTI-80 (9.90 m) when compared to other collections. However, the highest fruit yield of tamarind was recorded in NTI-14 (25.35 kg/tree), NTI-19 (25.10 kg/tree) and SMG-13 (24.75 kg/tree) as compared to other provenances.

Among the ten tamarind clones *viz.*, V-2, TH, H-5, P-11, S-132, U-112, PKM-2, B-1, S-201 and HR-107 evaluated in degraded soil conditions, the maximum height was recorded in V-2 (13.10 m), PKM-2 (12.15 m) and TH (11.75 m) whereas, the highest fruit yield of tamarind was recorded in the PKM-2 (11.50 kg/tree) and V-2 (10.10 kg/tree) when compared to other tamarind clones.

Among the eleven provenances of *Pongamia pinnata viz.*, RAK-103, RAK-106, RAK-11, RAK-90, RAK-22, RAK-5, RAK-89, MTP-1, MTP-II, MTP-III and DPS-4 evaluated the significantly higher height and volume of the tree was observed in the MTP-I (8.90 m and 0.084m^3/tree respectively) and MTP-II (8.41 m and 0.078 m^3/tree respectively) when compared to other provenances. The highest seed yield of *Pongamia pinnata* was recorded in RAK-22 and MTP-II while the maximum wood moisture was recorded in the RAK-89 and MTP – III in comparison with other provenances.

In the multi-location trial on clonal evaluation of *Melia dubia* based agroforestry systems, the maximum height and DBH were recorded in the MTP-1 (9.43m and 25.78 cm respectively) followed by MTP-II (9.19 m and 23.29 cm respectively) when compared to HN (Hole Narsipura) clone (8.47 m and 24.80 cm respectively).

Among the seven varieties of *Emblica officinalis viz.*, Kanchan, NA-6, Chakaiya, NA-7, NA-10, Banaras, Dharwad evaluated, the maximum height and collar diameter were recorded in Kanchan (1.66 m and 4.90 cm respectively) followed by Banaras (1.56 m and 3.97 cm respectively) as compared to other clones.

Among the seven *Carissa carandas* sources evaluated, significantly maximum height and collar diameter were recorded in the Tumakur (1.73 m and 19.10 cm respectively) and Arabhavi (1.16 m and 15.43 cm respectively) as compared to other sources.

Among the nine provenance of thornless bamboo species with 4 different clones of evaluated, *Bambusa balcooa* of Chandagad (7.60 m) provenance attained maximum height followed by *Dendrocalamus stocksii* of Nasik (7.26 m) when compared to other bamboo species. The number of new culms were higher in *Bambusa balcooa* of Chandagad (5.63 culms) and *Dendrocalamus stocksii* of Dapoli (4.80 culms).

ii) System Research

In an investigation of sapota - timber tree species-based agroforestry system, the height and basal area was significantly higher in the *Pterocarpus marsupium* (14.70 m and 0.148 m^2/tree) when compared to other tree species whereas the highest volume was also recorded in the *Pterocarpus marsupium* (1.09 m^3/tree). Sapota growth was higher when grown alone (6.65 m) followed by Sapota + *Pterocarpus marsupium* (6.25 m). Fruit yield of sapota was significantly higher when sapota grown alone (40.50 kg/tree) and in Sapota + *Lagerstroemia lanceolata* (22.25 kg/tree) when compared to other tree species.

Among the six tree borne oilseed species *viz., Pongamia pinnata, Simarouba glauca, Azadirachta indica, Aphanamixis polystachya, Madhuca indica* and *Calophyllum inophyllum* evaluated, the maximum height was observed in *Azadirachta indica* (8.50 m) and *Madhuca indica* (8.10 m) whereas the maximum dbh was recorded in the *Simarouba glauca* (19.95 cm) and *Azadirachta indica* (18.56 cm) when compared to other species.

Among the seven fodder tree species evaluated under agroforestry system, maximum collar diameter was recorded in the *Leucaena leucocephala* (12.00 cm) followed by *Moringa oleifera* (10.00 cm). The number of

branches per tree and green biomass were significantly higher in *Calliandra calothyrsus* (35.10 branches/tree and 1325.0 kg/ha respectively) when compared to other fodder tree species. The soybean grain and haulm yield were significantly higher when grown as a sole crop (995.2 kg/ha and 775.9 kg/ha respectively) and when grown in combination with *Bauhinia purpurea* (898.6 kg/ha and 690.2 kg/ha respectively) when compared to other fodder tree species.

At ARS, Prabhunagar, the biomass and carbon sequestration were estimated in the natural forest in the four sloppy areas. Among the different slopes, the maximum density of tree species was observed in the middle area (3-5%) as compared to the plain, low and high area. Significantly higher biomass and carbon sequestration was recorded in the middle hill area (3-5%) as compared to top, terrain and low area of the hill. Among the tree species, significantly higher biomass and carbon sequestration was recorded in *Anogeissus latifolia* (30.16 ton/ha and 15.08 ton/ha respectively) as compared to other tree species.

An experiment to estimate the biomass and carbon sequestration of different timber tree species grown with sapota based agroforestry systems at ARS, Prabhunagar indicated that, the total biomass and carbon sequestration was significantly higher in *Eucalyptus tereticornis* (167.59 ton/ha and 83.80 ton/ha respectively) and *Tectona grandis* (96.70 ton/ha and 48.35 ton/ha respectively) as compared to other timber tree species in the agroforestry system. Among the sapota trees, total biomass, carbon stocking and sapota fruit production was higher in sapota with *Lagerstroemia lanceolata* (10.25 ton/ha and 5.13 ton/ha respectively) when compared to other agroforestry systems.

In the multi-location provenance trial on *Pongamia pinnata,* the maximum height and collar diameter at breast height were recorded in RAK-1 (4.75 m and 15.50 cm respectively) followed by RAK-7 (4.25 m and 15.05 cm respectively) when compared to other sources.

In the multi-location trial on fodder tree species in paired row system for leaf meal production, the maximum collar diameter was recorded in the *Gliricidia sepium* (5.75 cm) followed by *Sesbania grandiflora* (5.45 cm) as compared to other species. The number of branches and green biomass were significantly higher in *Calliandra calothyrsus* (10.00 branches per tree and 3150.5 kg/ha respectively) when compared to other fodder tree species. Dry matter analysis carried out for the fodder tree species revealed that, in comparison with other fodder tree species, both *Moringa oleifera* and *Sesbania grandiflora* were higher in energy and had good digestibility.

In a study on establishment and growth performance of *Santalum album,* the seedlings raised in the nursery and planted with seven fodder tree species *viz., Sesbania grandiflora, Gliricidia sepium, Moringa oleifera, Calliandra calothyrsus, Leucaena leucocephala, Albizia lebbeck, Bauhinia purpurea* as secondary host trees.

In a study on effect of integrated nutrient management and spacing on growth and productivity of Red Sanders, the seedlings raised in the nursery were planted in the block plantation.

UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU

i) Tree germplasm collection, Evaluation and improvement

We are evaluating 27 germplasms of Tamarind, 8 germplasms of *Pongamia pinnata*, 2 germplasms of *Melia dubia* and 2 germplasms of Casuarina.

ii) System Research

- Among twenty-seven tamarind germplasms NFN-6 showed higher growth attributes.
- In Spacing trail of *Melia dubia* higher plant height and girth at breast height was observed in 24m X 5m spacing.
- Higher Carbon sequestration potential and Growth were observed in RAK-2015-10 germplasm of Pongamia compared to other eight germplasms.
- In Teak based agroforestry experiment 12m X 3m spacing showed higher growth attributes along with higher carbon sequestration potential. However, intercrops (Fodder crops) *viz*. Co-3, Co-5, Super Napier, BNH-10 and Guinea showed superior growth.
- Soybean intercrop performed better in 5m x 5m spacing in sandal-based agroforestry system followed by 5m x 4m compared to cowpea intercrop. Whereas higher tree height of sandal was also observed in 5m x 5m.
- Tree planting of Mahogany at 5m X 5m spacing recorded the highest tree height followed by 5m X 4m and similar trend was recorded for collar diameter.

Among the intercrops both Cowpea and Soybean performed better in spacing of 5m X 5m.

- Population count of soil microflora were found significantly more in the plots with intercrops than plots with only tree crops
- The maximum enzyme activity was recorded during the flowering stage of the intercrop and was recorded higher in the horti-based agroforestry system - mango + sun hemp.
- Microbial biomass carbon and nitrogen was found to be quantitatively higher in the intercropped plots and mango + sun hemp system was noticed with relatively higher values.
- With the practice of growing intercrop along with trees, the organic input added to the soil in forms of leaf litter, dry plant materials, etc., was a favourable factor in improving the soil organic carbon content.
- Mango is witnessed as a good tropical evergreen tree that could be chosen as tree crop for horti-based agroforestry system. It is found to be ecologically and economically a good choice to incorporate mango as a component in the agroforestry system

KERALA AGRICULTURAL UNIVERSITY, THRISSUR

In the teak provenance evaluation trial, Nilambur provenances like Cherupuzha, Nedumkayam-2, Nellikutha-5, Nedumkayam-1 and Karulai showed superior growth as compared to provenances from other regions.

In the reporting year various teak provenances were screened based on wood quality and growth parameters. Growth characters and stem quality varied significantly among the provenances. The highest value for height was observed in Nedumkayam-1 (17.97m) which was on par with Karulai (16.52m). Among the accessions, highest value for girth was observed in Karulai (86.07cm), followed by Nellikkutha 5 (72.51cm) and Cherupuzha (70.87cm). Pilodyn penetration depth (PPD) was least in Nellikutha-6 (20.25mm) which was on par with Cherupuzha (20.25mm). Highest value for stress wave velocity was observed for Thiruvazhamkunnu (4360.21 m s^{-1}), which was on par with Nellikutha-1 (4322.26 m s^{-1}) and many other accessions. In general, Nellikutha-5 showed better growth parameters and wood quality traits.

Cereal fodder intercropping trials in homegarden and coconut garden revealed that, fodder maize (African tall) can be successfully, and cost-effectively cultivated in these partially shaded tree-based systems with minimal yield reduction. Bajra showed moderate performance under shady situations whereas sorghum yielded very poor results.

In home garden, the cumulative yield (from two harvests) of maize was 57.16 and 73.50 Mg ha^{-1} with a yield reduction of 38.72 and 21.23% than open cultivation during *rabi* and summer seasons. In coconut garden, maize recorded a yield of 71.60 and 77.35 Mg ha^{-1} in *rabi* and summer with a yield reduction of only 7.49 and 11.79% than open cultivation. In comparison, yield reduction was higher under homegarden with low PAR transmission (41%) than that of coconut garden with higher light availability (56%).

Quality attributes like crude protein (CP), crude fiber (CF) and ash content (AC) was also superior for maize than other fodders. The CP content was higher and CF content lower in partially shaded homegarden and coconut garden, whereas the dry matter and ash content was more in open fields.

In bamboo (*Dendrocalamus stocksii*) based agroforestry trial with medicinal intercrops, Kasthuri turmeric (*Curcuma aromatica*) performed well under bamboo plantation spaced 8 m x 8 m with a rhizome yield of 27.16 t ha^{-1}, followed by turmeric (25.04 t ha^{-1}). Ginger showed moderate performance, whereas alpinia was found to be a poor yielder under bamboo plantations. Performance of intercrops showed considerable variation with respect to various spacing of bamboo. All crops except ginger produced more yield under wider spacing of 8x8m, whereas ginger yield was better under medium spacing of 6x8m.

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- **Development of *Dendrocalamus stocksii* Munro. based agroforestry practice for the tropical humid regions:** Existence of difference in the growth performance of the bamboo under different spacing regimes was evident in the study. It is a long-term experiment and the intercrops like ginger and turmeric failed due to diseases and repeated growing of same crop led to failure of the crops. We were able to harvest only 400 kg of turmeric from the entire experimental plots.
- **Collection and evaluation of bamboo resources for sustainable utilization**: Experiment on collection and evaluation of bamboo resources for sustainable utilization has been continued. A significant difference in the growth performance of different species was evident
- **Establishment of agroforestry models with the support of other funding agencies:** Unable to accomplish the task due to COVID 19 pandemic

i. **The centre has got the support from national bamboo mission to establish bamboo-based agroforestry model:** Bamboo based agroforestry model has been established in association with the farmer and the effect of spacing and nutrient regimes on the growth performance of *Dendrocalamus brandissi* was assessed and important vegetable ladies' finger was taken as an intercrop during *kharif* season and blackgram was sown as an inter crop during *rabi* season.

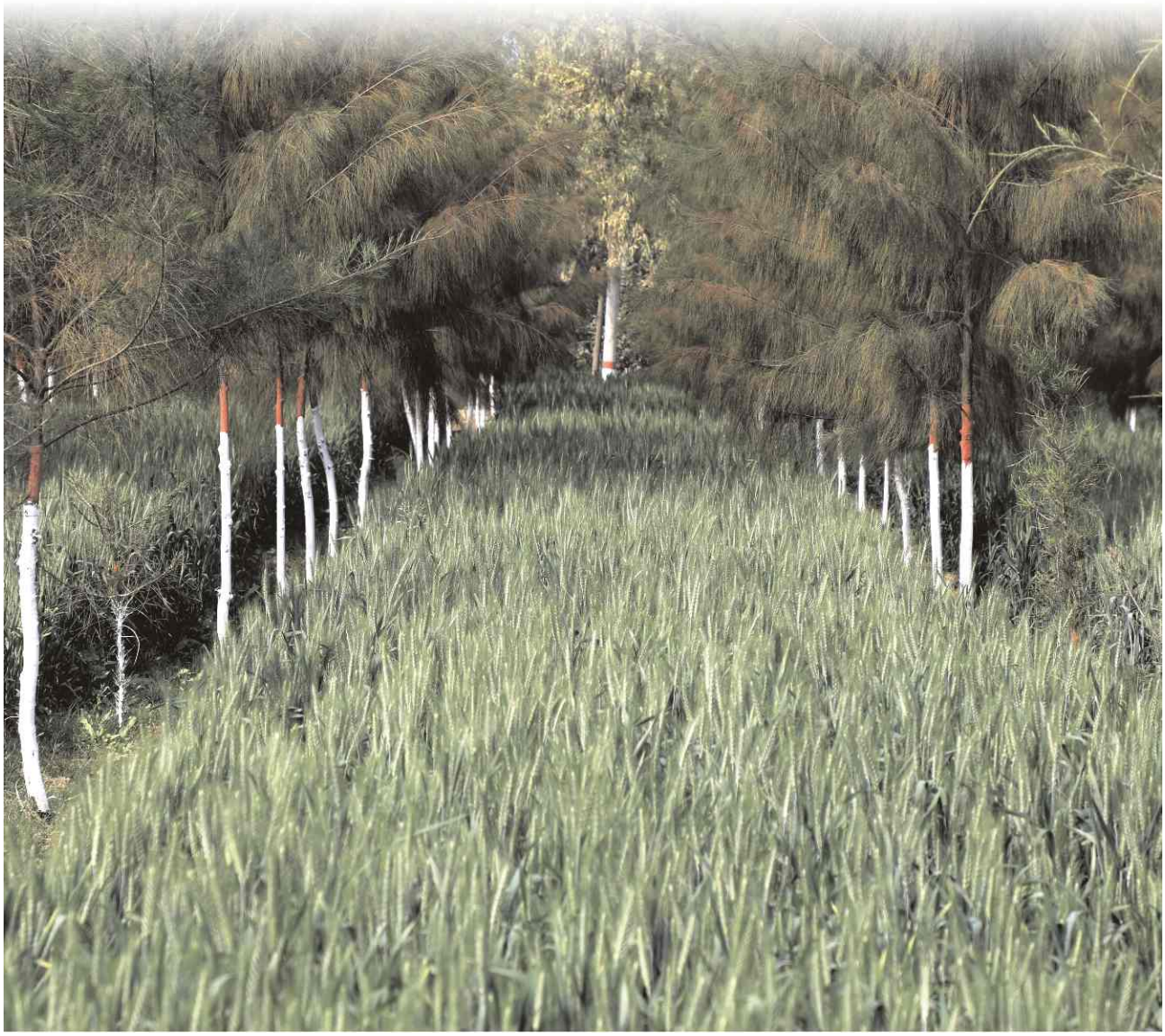
ii. **Establishment of *Litsea* based agroforestry models:** *Litsea chinensis is* one of the important tree species yielding raw material for incense stick industries. Block plantation of *Litsea chinensis* was established with 180 plants at MAHRS, Iruvakki during the year 2021-22.

i) Survey, Diagnostic and designs

The study was carried out in the remaining parts of the Kodagu district. The farmers of the region Hill zone are mainly practising with plantation crop combination. Most of the planters cultivate Coffee with some native shade trees which are compatible. Nearly 25 per cent of the land is being used for paddy. Cultivation by planting some hedge rows and border row planting with silver oak is common in the region. Small farmers of the region do mix with all type of domesticated fruit trees (40%), timber trees (20%), wild edible fruit trees (10%) in their farm without the intention of income.

ii) Tree germplasm: Collection, Evaluation and Improvements

Seeds from phenotypically superior mahagony trees were collected and 1500 seedlings were raised with identity for distribution to the farmers for field planting



4. Subsidiary Activities

SKUAST-K SRINAGAR

Agroforestry and allied activities for TSP was conducted in village chountwaliwar and a Seven days training on "Rebuilding carbon sink and developing Entrepreneurship skills through quality plant production of Conifers and Broadleaved tree species for Tribal community of Kashmir" (16th March, 2022 to 22nd March, 2022) was also conducted. Along with participation in Kissan Mela.

Tree plantations drive as well as tree plantation awareness programs were conducted along with Division of SAFIN Collaboration with Rahim Greens (NGO), state forest department at degraded lands and Govt degree college Kupwara, respectively

SKUAST-J, JAMMU

Tree planting campaign, "*Har Med Par Ped*" on 'Azadi ka Amrut Mahotsav' conducted at RS Pura, Jammu

YSPUHF, SOLAN

500 plants of different bamboo species and camphor were planted in the Tree planting programme and two days training programme was organised on the grafting technique of *Terminalia chebula* Khagal farm (COH&F) of Dr. YSPUHF

CSKHPKV, PALAMPUR

An awareness meeting on the concept of *Har Medh Par Ped* was organized for 30 farmers at village Mallahu, Tehsil Palampur, Distt. Kangra (HP). Three agroforestry training were organized in Tribal district of Lahaul & Spiti for 25 trainees and an agroforestry training was organized in village Mollichak in which 44 farmers participated. A total of 307 demonstration trials were raised in village Mollichak and Band Bihar.

AAU, HRS, KAHIKUCHI

A nursery with a production capacity of around 20,000 numbers for indigenous plant species at Assam has been started during 2021-22 at HRS, Kahikuchi centre. 6 training programmes and 3 awareness programmes were conducted in this year which benefited around 91 farmers. Especially, Vermicompost preparation bags, Apiary boxesdistributedto10numbersofbeneficiaries and also planting materials were distributed in Baksa and Tamulpur districts. Training imparted to SRLM officials at NIRD, Guwahtaias National Resource Person (NRP) of NIRD, Hyderabad. Periodical trainings to KVK, Nalbari,Nagaon, Kharua, Baksa, Tamulpur and Morigaon; and Jawaharlal Nehru College, Boko, Kamrup.

Recognition by NITI Aayog, Agroforestry

Kamrup district of Assam was selected in All India for Ground Truthing of agroforestry areas identified through GIS mapping by ISRO. Honourable Vice Chancellor, AAU Jorhat has nominated Ranjita Bezbaruah, Scientist & OIC, AICRP on Agroforestry, HRS, Kahikuchi

Establishment of demonstration blocks:

Presentation on Agroforestry models developed by AAU during the meeting organized by Commissioner & Principal Secretary, Forestry, Govt. of Assam on 25.03.2022 at Secretariat, Dispur. Demonstration of Horti–Horti agroforestry model at Puthimari, Kamrup district with the provision of Turmeric 9 Var Megha turmeric), Pineapple (var Kew), Papayaseed, Assam Lemon saplings. Demonstration of 1000 numbers of strawberry at Ambari, Tamulpur under TSP programme along with Pothythene mulch.

Meeting attended with Govt departments in regards to Promotion of Agroforestry in Assam-

- Attended meeting at ARANYA Bhawan with PCCF & HOFF, IFS Social Forestry
- Meeting with R. S Prashad Commissioner & Principal Secretary, Forestry, Govt of Assam
- Resource person on 'Workshop on the convergence of MGNEREGA with other development programmes organized by SIPRD, Kahikuchi Campus, Guwahati
- Organized an exposure trip of TSP farmers under AICRP on Agroforestry to HRS, AAU, Kahikuchi on 24.03.2022
- Plantation of trees at Puthimari Rangia and Narengi Guwahati on the occasion of ICAR's Foundation Day-Har Med Per Pad and also in collaboration with BSF, Frontier HQ, Guwahati at Rani under Plantation Drive programme 2021
- Resource person- online training on SRP organized by NIRD & PR, NRLM, RC, Khanapara, Guwahati
- Resource person on tree based intercropping system for clime resilience under online training organized by NIRD & PR, Khanapara, Guwahati
- Resource person in imparting virtual training on Tree based cropping system organized by NIRD PR -NERC, Khanapara

PAU, LUDHIANA

Conducted Awareness programmes on Boundary Plantations

GBPUAT, PANTNAGAR

- Different Agroforestry models were demonstrated and 15 days on hand training was organized for two teenagers from SC community to raise and maintain the shisham nursery
- Tree plantation and awareness Programme on the Theme "Har Medh Par Ped" to mark the celebrations of India@75 – Azadi ka Amrut Mahotsav and an awareness cum training of agroforestry was organized to sensitize the homemaker' ladies at Village

Padampuri, Block Dhari, District Nainital – Uttarakhand. Also a kisan goshthi was organized at village Khamaria, block Baheri, District

ANDUAT, AYODHYA

Nearly sixty farmers were provided training by the university scientists with collaboration from Coordinating Unit, Jhansi that 'Centres to conduct boundary plantation/bund plantation (Har Medh Par Ped) awareness programme', on topic "Medon per vriksharopad" awareness programme

Under SCSP - Turmeric seed NDH-1 distributed to the 70 SC farmers of Meen Nagar village, Dariyabad block, Mango, Teak and Karonda seedlings and Vegetable Seeds were distributed to the more than 100 SC farmers of Meen Nagar village, Dariyabad block and distribution of wheat, paddy seeds to the SC farmers of Meen Nagar village, Dariyabad block.

RPCAU, PUSA

Parthenium awareness week was observed. Important tips were given to CRPF at Mokama ghat (Patna), participated and exhibited different models and demonstrations in Kisan Mela-2022

Lecture delivered on the topic "Vermicompost/compost and agroforestry nursery management" during a "training program on Compost Production Technology" organized by Vermicompost Production Unit, Department of Soil Science, RPCAU, Pusa on 27.07.2021. The training was imparted to the Sashastra Seema Bal of Muzaffarpur headquarters.

OUAT, BHUBNESHWAR

Telecast and broadcast on agroforestry systems in Electronics media and one Awareness Programme on bund plantation of fruit plants. Two Agroforestry awareness training to the farmers of ICRAF project at Belpada and Nuapada Block. Two skill development training for rural youth at KVK, Nayagarh & Dhenkanal and total 20,000 seedlings and suckers raised and sold to the farmers

BCKVV, RRS, JHARGRAM

Maintenance of 2.81 hectares of agroforestry models and need-based advisory to all 18 beneficiary farmers and capacity-building training to villagers at Ramnagar village of Binpur I block of Jhargram District and capacity-building training to villagers of Satyapole, Kapgari and Lalgarh village.

BAU, RANCHI

"Har Medh Par Ped" campaign was organized

CCSHAU, HISAR

Boundary plantation awareness programme

SKNAU, ARS, FATEHPUR-SHEKHAWATI

As per QRT suggestion establishment of arboretum/ biodiversity park 50 species of tree/shrubs and grasses planted and conserved at station.

"Har Med par Ped" tree plantation awareness programme organized during the year and 1100 MPTS plants planted on farm boundary of the station and 21 days training course 1-21 December, 2021, DEE, UBKV, West Bengal (virtual mode). During the year from auction of trees of Ailanthus excelsa Rs 187,273.00, Trees of Acacia tortilis Rs. 80768.00 and auction of grass Rs 3500 revenue generated.

SKDAU, SARDAR KRUSHINAGAR

Conducted awareness programme on "Har Med Par Ped". Paid visit to the SCSP Farmers of Jethi Village and TSP Farmers of Vagadadi Village. Exhibition on arid fruit crops and Agroforestry and RAWE student of Agriculture and Horticulture training. Visit to the SCSP Farmers of Jethi Village. Exhibition on arid fruit crops and Agroforestry during

MPKV, RAHURI

Tree plantation programme where two hundred Tamarind saplings were planted, and six training programmes conducted.

PDKV, COA, NAGPUR

Dr. V. M. Ilorkar addressed 13 Training Programme and organised three tree plantation and one training to farmers and medicinal plant distributed to the farmers under NMPB project.

JNKVV, JABALPUR

Awareness programme (*Har Medh Par Ped*) and five capacity building programme organized under SCSP. Also distributed seeds and planting material.

PJTSU, HYDERABAD

Two tree plantations were with theme of "*Har Med Par Ped*" with tree plantation programme (Haritha Haram) and six trainings Organized to farmers

BSKKV, DAPOLI

"*Har Medh Par Ped*" awareness programme was conducted in Sukdhar Village of Dapoli Tahsil in Ratnagiri district of Maharashtra (>40 farmers participated). Training Program on Goat Management under silvopastoral system conducted at Asond Block of CES, Wakawali (>25 farmers participated).Training Program on Agroforestry conducted at Bhorghar, Tah. Mandangad, Dist. Raigad (>30 farmers participated).

TNAU, METTUPALAYAM

- During 2021–2022, 1165 visitors visited AICRP trials (Scientists, Farmers, Stakeholders, Forest Range Officers, Foresters and students)
- Scientists co-organized and participated in the 5th Annual Workshop of the Consortium of Industrial Agroforestry.
- 12 number of training programs/workshops were organized for the benefit of stakeholders.

TNVASU, KATTUPAKKAM

Tree plantation programme where 100 *Manilkara Zapota* saplings were planted. and one-day training was conducted for 60 SC farmers at the Institute of Animal Nutrition, Kattupakkam.

UAS, DHARWAD

Two awareness programme for the farm women at Agroforestry Center, UAS, Dharwad, three tree Planting Events and ten Farmers Training Programmes were conducted.

UAS, BANGALORE

- Two training programmes under Tribal sub plan and Schedule cast sub plan in Bagepalli taluk, Chikkaballapur district, Karnataka. Agroforestry training programme in both online and offline mode.
- Dr. Hanumanthappa, D.C., Agronomist, attended two workshops, training, event, participated in National E-Seminar and presented a paper and attended "Integrated Digital Agricultural System preparation session" as a resource person
- Mr. Ganesha, B.H, SRF, attended the event two events and participated in one national seminar along with Dr. Hanumanthappa.
- Mr. Bhaskar, V. Visited to Raitha Samparka Kendra, Kasaba, Nelamangala as a resource person to an event organized by RSK, Nelamangala.

KAU, THRISSUR

- Conducted Webinar on "Promotion of trees in agro-ecosystems of Kerala with focus on Bund and Boundary planting" as part of the "*Har Med Par Ped*" Campaign on Tree Planting in Bund and Boundaries of Farmlands, in connection with the ICAR Foundation Day and as part of Celebration of India@75- 'Azadi ka Amrut Mahotsav' from 11.00 am to 1.00 pm on 15th July 2021.
- One day training programme on "Scientific cultivation of bamboos in Kerala" organized for SCST farmers of Madakkathara and Pananchery panchayaths by SCSP sub-plan and AICRP, COF on 9th March 2022.
- Extension of Miyawaki forests at cochin (Green and Swatch SEZ) refinery area. Inaugurated by Collector on 20th September 2021.
- Under the auspices of Ayush Department and State Medicinal Plants Board, inauguration of the medicinal plants seed centre at the College of Forestry, training on medicinal plants cultivation and distribution of seedlings to farmers was undertaken on 25th September, 2021. Fodder bank technology transferred to farmers to Adimali panchayath, Idukki Dist.

UAHS, SHIVAMOGGA

- Delivered online talk on Cultivation of Bamboo to the farmers of Karnataka as part of World environment day
- Participated as resource person Interaction on bamboo cultivation and marketing organised by the Cauvery Calling, ISHA foundation Coimbatore.
- Organised training programme on Bamboo cultivation to the staff of Industry foundation. Training programme on Forest Research Methodology was conducted to the Research staff of Karnataka Forest Department. Agroforestry Technology Workshop was organised by involving farmers and staff of Karnataka Forest Department.

Awareness Programme on Boundary Plantation "*Har Med Par Ped*"

Institutes name	Training	Date	Place
SKUAST-K, SRINAGAR	Boundary plantation	12.01.2022	Countwaliwar
SKUAST-J, JAMMU	Boundary Plantation	29.10.2021	village Darsopur, Jammu
YSPUHF, SOLAN	Boundary Plantation	10.08.2021	Pachghat panchayat of Solan district
AAU, HRS, KAHIKUCHI	boundary plantation (5 nos.), bund plantation(1 no.),	01.03.2022	Baksa
	Sivipasture in Agroforestry system	16.07.2021	ICAR CAFRI JHANSI
PAU, LUDHIANA	Boundary plantation awareness	01.06.2021	TV talk
GBPUAT, PANTNAGAR	Boundary plantation awareness	05.03.2022	Gadarpur Tehsil of Udham Singh Nagar
RPCAU, PUSA	Boundary plantation awareness	14.06.2021	Vllage: Malikor; Block: Pusa (Samastipur)

BCKVV, RRS, JHARGRAM	boundary plantation in a 25 hectares cashew-based Agroforestry	01.03.2022	Salboni block of West Midnapore
CCSHAU, HISAR	Boundary plantation awareness progamme	29.12.2021	village Ranila, district Bhiwani
MPKV, RAHURI	Boundary plantation awareness progamme	2021	Shri Bhaskar Madhav Shete from Gotumbe akhada village.
PJTSAU, HYDERABAD	Boundary plantation	01.07.2021 07.08.2021	Vedirepally village, Thimmajipet Mandal
TNVASU, IAN, KATTUPAKKAM	Boundary plantation	12.01.2022	Venpakkam village, Chengalpattu District
UAS, DHARWAD	Awareness Programme on 'Bund/ Boundary planting'	27.08.2021	Narendra Village, Dharwad
TNAU, FCRI, METTUPALAYAM	Three boundary plantation programmes	10.01.2022 21.01.2022 28.01.2022	Kallar village, Mettupalayam Vadavalli village, Karamadai FCRI, Mettupalyam
UAHS, SHIVAMOGGA	Awareness programme on boundary planting	23.06.2021	Village Halligattu, Ponnampet
CSKHPKV, PALAMPUR	Awareness programme on boundary planting	18.12.2021	village Mallahu, Distt. Kangra
JNKVV, JABALPUR	Awareness programme on boundary planting	29.12.2021	village Goura, district Jabalpur
OUAT, BHUBANESHWAR	Awareness programme on boundary planting	23.07.2021	Village Kothagada, Patnasahi, Puri
	Awareness programme on boundary planting	29.10.2021	Village Mangarul, Nagpur
SDAU, SK NAGAR	Awareness programme on boundary planting	04.03.2021	Village Jethi, Banaskantha
ANDUAT, AYODHYA	Awareness programme on boundary planting	21.05.2021	Village-Jorium, Ayodhya

Success Stories of Tribal Sub Plan

Odisha

1. Title :

Backyard poultry rearing a new income generating approach to the tribal women Self Help Group (SHG) in Odisha

2. Challenge

Young and old tribal women of the village Majhisahi (Kankadahada, Dhenkanal) in Odisha were engaged in collecting minor forest produces from the forest and after primary processing they sold it in the weekly markets in nearby urban and semi-urban areas with meager profit. A women self help group name "Pilchu Budhi Nari Sangha" was formed in this village in order to have round the year engagement and earning through different non land based ventures.

3. Initiative

The Scientist (Mrs. Sasmita Behera) of AICRP-Agroforestry from OUAT, Bhubaneshwar and Subject Matter Specialist Veterinary (Dr. Roshni Bala Nayak) of KVK, Dhenkanal encouraged the tribal women SHG members to rear improved poultry birds, however they had little knowledge on the rearing of poultry birds, hence AICRP on Agroforestry, Bhubaneswar centre arranged a poultry rearing vocational training and an exposure visit to the poultry unit of KVK, Dhenkanal

4. Key result/insight/interesting fact

In the initial stage, 250 nos. of 21 days vaccinated chicks of dual purpose "*Pallishree*" poultry breed from KVK-OUAT hatchery were supplied to 25 active members of tribal woman SHG. The chicks were provided with mineral mixture supplements along with tonic for better growth and development. Regularly, the birds were fed with kitchen waste like waste vegetable cuts, leaves, broken rice, left over etc. and birds were allowed to move in to the backyard for feeding. These birds attain body weight of 2-2.5 kg after four months of rearing and started laying eggs after five months. The women SHG members able to get 150-165 eggs from each bird and sold at Rs.5/- per egg and after a year their layer birds were sold at Rs.250/- to 300/- per birds, thus each birds give an income of total Rs.1,000/- to 1,100/-. They also sold male birds (cocks) at 2-3

months stage at Rs.400/- to 500/- per bird for meat purpose

5. Impact

The tribal women SHG members could earn a lot without any extra labour which encouraged them to rear more birds. They have purchased more chicks from KVK-OUAT poultry unit and reared in their backyard and continued this business without much support from their husbands and other male members of the families. In backyard rearing, each family could easily handle 20-25 birds as the feed cost was negligible. In a short time span (10-12 months period), each lady member could achieved net income of Rs.25, 000 - 30,000.

6. Lessons Learned

The success of these SHG members in backyard poultry rearing provides hope and impetus to other SHG groups and individual tribal farm families nearby villages to take up this profitable venture.

Poultry Rearing by Tribal Women Self Help Group of Majhi sahi, Dhenkanal, Odisha

Himachal Pradesh

1. Title

Action Research towards Greening Spiti Valley

2. Challenge

In the year 2018, as per the directions of Niti Ayog , work under TSP component was to be carried out only in designated tribal districts of the state so that the benefits of the scheme could reach the tribal farmers and make some visible economic and ecological impact.

Keeping in view this, a village Sichling (32.0815° N and 78.2070° E) situated at an altitude of 3594 m in cold desert area of Distt. Lahaul & Spiti (HP) on the banks of river Spiti was selected. It is situated about 35 km away from Tabo on Tabo-Kaza road. Main criteria for selection of the village were remoteness from the main cities, harsh conditions and interest of the farmers for adoption of scientific systems of farming. Sichling is a small village of 18 households with a population of about 110, with a farm area of about 15ha and livestock population of 260 comprising of sheep and goat (200) and cows and churu (60). A huge seasonal variation is exit in the climatic conditions ranging from short and dry summers with harsh sunlight (Maximum temperature reaching up to 360C during the day) to long windy and freezing winters (minimum temperature touching -32oC at night). These areas have only 6 months growing period where water resources are minimal and comprise glacier fed Spiti river. The soil strata is loose and prone to erosion. Soils are mainly sandy loam to silty loam having pH neutral to alkaline. The soil of the area is not very fertile, low to medium in organic carbon and available nitrogen, whereas available soil is medium to high and available potassium is medium. Potato, pea, barley, cabbage and wheat are the main crops being cultivated. The farm area of the village has scattered trees of apple, chuli (wild apricot), poplar and salix.

During the period, awareness program and agroforestry training was organized in the village where farmers discussed their farming problems and acute

fodder scarcity. They had been cultivating Pea as the major cash crop and even in that they were not following good agro-techniques being not aware of these. Traditional method of broadcasting is follower in which 5-6 times higher seed rate than the recommended practice is being used by farmers leading to increased cost of inputs, plant density, unequal distribution, problems in interculture operations and harvesting of the produce. Non availability of quality seed was another important issue, and they had no alternative than to use costly seed from the private companies.

Since the last one decade, the economy and livelihood of the farmers in the adjoining villages of Tabo, Lari, Hurling, Chango and Nako has got a great boost and uplift through apple cultivation which is famous for its quality, shelf life and is fetching a very high price in the market. This was the main reason that farmers of Sichling also wanted Apple based agricultural farming system.

During time when project activities were initiated, several requests were received from Numbardar (Local Representative) of village Sagnam in Pin valley to organize an awareness or training program in their village also. Sagnam is situated in High Hills Temperate Zone of Western Himalayan Region at a height of 4085 amsl and at 32.03 06° N latitude and 78.05 70°E longitude in Pin valley. The village remains covered with snow from November to April and there is only one cropping season. Pea is the major cash crop of the area, sown after clearing of snow in April and harvested in the month of September. Livelihood of majority of farmers of this valley depend upon Pea crop which goes to the market as off-season crop and fetches high price. Livestock is an integral component of their farming and so there was no dearth of organic manure but an acute scarcity of fodder. Challenge was again the availability of quality planting material of fodder trees, quality seed of pea, lack of knowledge about the scientific concept of line sowing, spacing and GAP.

3. Initiative

- The best scientific solution recommended to the farmers of village Sichling was the adoption of suitable, location specific agroforestry systems like Horti-silvi-pastoral, Horti-silviculture, Horti-agri-silviculture to provide both economic and ecological benefits to the farming community of that region. Initially only five farmers came forward to adapt the scientific technology of agroforestry and other good agronomical practices. The aim was basically to develop a location-specific need based replicable agroforestry system model which could be adopted/followed by others in the region. The work was initiated on 0.5 ha area (belonging to the five farmers) in collaboration with the scientific team of Krishi Vigyan Kendra Tabo of University of Horticulture & Forestry, Solan.
- The land area was surveyed, and soil sampling was done before recommending any system. Different agroforestry systems were recommended depending upon the need of the farmer, land suitability and availability of resources. Copy of basic documents like caste certificate, land papers and aadhar card were procured from the farmers before adopting them as beneficiaries in the project.
- During trainings, farmers were imparted theoretical and practical training on various aspects of agroforestry especially on the concept of Silvi-pastoral, Horti-silvi-pastoral, Horti-agriculture and boundary plantation, wind breaks etc. as per the topography of the region and priority requirement of the horticulture and fodder. Due to scarcity of cultivated land, the concept of growing improved grasses on the field bunds and in the orchards was also advocated. Farmers were imparted knowledge on planting and management of trees, designing of orchard plantation, significance of pollinators, proper ratio and position of pollinators in the orchard, economical and ecological benefit of each component of the agroforestry system etc.

- After laying out the requisite design of the systems, markings were given for pit digging and then at the time of planting season, quality planting material of Apple (spur varieties), Salix (fast growing clone developed by UHF Solan), seed of multi-cut Leucerne grass along with other basic inputs were provided to the farmers for raising the demonstrations of the systems on their fields. In addition, these farmers were also provided quality seed of university recommended Pea variety Punjab-89 and demonstrations were raised through peoples' participatory approach to make them learn Good Agronomical Practices (GAP) and to make best use of their human, land and other natural resources.
- At some points, fencing of inter-linked chain was also provided to the beneficiaries for protection from damage of animals.

- In the next planting season, demonstrations were raised on Organic Pea cultivation and in addition only 50 saplings of Salix could be provided to the interested farmers.

- Regular monitoring and interaction with the farmers at both the places is being ensured which is a key to confidence building between farmers and scientists and is resulting in more and more successful adoption of technology.
- Technical information published in the form of *Krishi Vaniki* Training Manual and Brochure on fodder production in High Hills through Agroforestry (in Hindi) were distributed to the beneficiaries for consultation.

4. Key result/insight/interesting fact

- There had been increasing demand for fast growing clone of Salix which is a lifeline for the human and livestock of the cold desert region. In the first year of adoption, only 50 plants of Salix were distributed and now in April 2022, 450 saplings were supplied though the demand was for more than 1000 saplings.
- Efforts and enthusiasm of the farmers to adopt the scientific interventions is apparent through achievement of >85% survival of *Salix*despite harsh weather conditions and livestock pressure during winter when animals don't have any grass blade to feed upon.

- In case of Pea crop cultivation,farmers had the following observations as compared to their earlier practices
- Less seed was used per unit area.
- There was uniform germination and population in the field.
- It was easier for different intercultural operations, irrigation and harvesting of the produce.
- There were a greater number of pods per plant, pods were filled, and pods were ready for harvesting at one time and saving manpower to a great extent.
- The total production was 1.5 to 2 times as compared to their earlier production because of quality seed, adoption of suitable agro-techniques and organic crop production technology.
- The total cost of cultivation was reduced to the tune of 10-15%.
- Finally, the area under agroforestry systems in village Sichling has increased from 0.5 ha to 0.94 ha in two years.

5. Impact

It is too early to quantify the large-scale impact at the system level but definitely, the scientific interventions at the ground level started bearing results after the very first year only.

Assam

1. Title

Livelihood generation through Agroforestry system

2. Challenge

The major problem of the area was the hillock where all types of crops couldn't be cultivated due to the problem of land preparation, water management and soil condition. The economy of the farmer was also not so good so he could invest more on his land. The distance of 100 km from the centre and frequent monitoring was a major problem but with awareness generation and provision of training, the technical know-how has been generated. Adoption of the systems scientifically also was a big challenge.

i) The land was available and interventions like horticultural crops and silviculture could be a prominent one to improve the livelihood of the farmer.

ii) There was a scope of the provision under TSP, AICRP on Agroforestry to assist the beneficiaries

iii) AICRP on Agroforestry, HRS, AAU, Kahikuchi during the year 2018-19 has selected the beneficiary for the improvement of the livelihood.

3. Initiative

As the arecanut based agroforestry system was a very prominent one. Therefore, the land was selected, and meetings and awareness generation have been done to initiate the activity. The beneficiary was also selected for the development of the system. There were some of the existing arecanut plantation already in the village. The village was bordering Garo hills of Meghalaya. The villagers already have developed very well-maintained different agroforestry models in his locality where planting materials of pineapple, arecanut and gamari etc have been provided to him from HRS, Kahikuchi centre under the AICRPAF project for an area of 1.0 ha. Research also have been carried out to calculate the output of the system. From the next year onward, he has started to get the return from the pineapple plantations. The initiatives have been taken place during the year 2016-17. The spacing of the pineapple ((22.5 x 60 x 75 cm) and arecanut (2.7 x 2.7 m) were maintained during the new planation. Gamari saplings were also planted with a spacing of 2.5m x 2 .5m. Thinning of the branches during winter month were done to enhance the quality of the wood as per suggestion of the scientists of the research station.

4. Key result/insight/interesting fact

Mr William Momin has started to earn around Rs 2,50,000/- to Rs 4,00,000/- from pineapple and Arecanut

5. Impact

He also has expanded his pineapple cultivation form one hectare are to around 3-hectare area on hillock. Gradually the suckers of the pineapple also been started to sale by him to a nursery at Goalpara district. Likewise, he has spread the technology to other villagers too and they also have started to earn. Mr Momin is a school teacher and so he has developed a nursery too in his village and used to guide the students for maintaining the nursery and to develop their interest in growing other trees along with fruit trees.

6. Lessons Learned

Farmer to Farmer extension is more successful in this region

West Bengal

Title : Agroforestry bring new hope for tribal people.

Western tract of West Bengal is chronically suffering from poor degraded porous soil. Agriculture is difficult due to frequent drought and low water holding capacity of the soil. Most of the peasants are tribal of Santhal community. They live in hamlet and depend on nonformal agricultural practices, collection of forest fuel wood and collection of *sal* (*Shorea robusta* C.F. Gaertn) leaf. They barely managed to make both ends meet.

Bidhan Chandra Krishi Viswavidyalaya (state agricultural university of West Bengal) centre of ICAR-

All India Coordinated Research Project on Agroforestry in collaboration with Soil Conservation Wing, Government of West Bengal started a project at Gaighata village, Salboni block of West Midnapore involving 269 beneficiaries of fifty-two families for their agroeconomic development through watershed development and agroforestry interventions. Initially, two water harvesting structures (25m X 25m X 4m) were constructed, around 10,000 cashew plants (95.23% survival rate) were sown in 2018. Gamars (*Gmelina arborea* Roxb.) are planted at 5m X 5m spacing on both side of road and boundary. Inter crops, cowpea, arhar, bottle gourd, cucumber and brinjal has been stated to grow in the inter row space of cashew plants from second year. Growth of cashew are satisfactory with life support irrigation. Last year the cashew flowers were discouraged to get good harvest in 2021 and they are expecting sustained return for coming forty years from cashew-nut sale in the local Contai market. *Gamars* are protecting the orchard from storms, other natural calamities as well as checking wind erosion and adding leaf biomass. This silvi component will also be harvest-ready within ten years for timber. Thirty-two hectares of culturable waste red and lateritic land into a greenery with cashew-based agroforestry. Cashew-based agroforestry system will be a feasible livelihood support model of converting poor marginal migratory manpower into self-reliant torchbearer of social, economic and ecological change in this tail end of Chotanagpur plateau.

5. Awards and Recognition

SKUAST-K, SRINAGAR

Awards and Recognition including participation in important National/International events Symposium/conferences etc.

S.No.	Date	Nature of activity/ Topic	Organized by	Mode	Staff
1.	15th Feb-07th March 2022	Conservation Agriculture for efficient resources-use and climate -resilient farming	ICAR-Indian Agricultural Research Institute, New Delhi	Online	Dr. Megna
2.	8th-31st March, 2021	Integrated solutions to environmental problems	Galile International Management Institute Israel	Online	Dr. Megna
3.	10th-12th May, 2021	Training Programme on "Agroforestry for Environmental Sustainability and Climate Resilience".	National Institute of Agricultural Extension Management,	Online	Dr. G.M. Bhat
4.	05th Nov, 2020	Livelihood promotion on Agroforestry	FOF, Benhama, Ganderbal		Dr. G.M. Bhat
5.	16th Feb to 8th Mar 2021	21 days training programme on Biophysical and socioeconomic interactionism	PAU, Ludhiana	Online	Dr. G.M. Bhat

Awards:

1.	**2021**	AICRP- AF-Photography Award-2021
2.	**2020**	Appreciation Award by Hon'ble Vice-Chancellor of SKUAST- Kashmir for outstanding contribution of region-specific Agroforestry model.
3.	**2020**	Certificate of Appreciation by Local panchayats in the field of Agroforestry

SKUAST-J, JAMMU

- Nutri-Cereals Multi-stakeholders' Mega Convention on 17-09-2021 (online).

YSPUH&F, SOLAN

- Dr. D.R. Bhardwaj received ISAF gold medal 2019

CSKHPKVV, PALAMPUR

- Success story of the Centre was released by Hon'ble DDG, NRM, ICAR, Senior advisor NITI Aayog and Director CAFRI on May 9, 2022.
- Brochure" Fodder production through Agroforestry System in High Cold Desert Areas of the State" was released by Hon'ble DG, ICAR during CAFRI Foundation Day celebration.

AAU, HRS, KAHIKUCHI

- Photography award received from ICAR-CAFRI, AICRP on Agroforestry, Jhansi

GBPUAT, PANTNAGAR

- Dr. Salil Tewari -Appointed as Member, Board of Management, FRIDU, Dehradun under distinguished scientist category, 2017-20 (now extended for 2020-22)

PAU, LUDHIANA

- Indian Society of Agroforestry Gold medal 2021 conferred to Dr. Rishi Gill
- Participated in IUFRO World Day and attended lectures on 28 and 29 Sept 2021
- Attended virtual Regional Expert Consultation on Agroforestry for Environmental Resilience and Sustainable Livelihoods of Farmers in Asia-Pacific (AFERSuLiF-AP) Jointly Organized by APAARI and CIFOR-ICRAF 13-14 Oct 2021
- Attended III Asia Pacific Urban Forestry Meeting (25-29 October 2021) – virtual event – organized by the Food and Agriculture Organization of the UN and the Royal Forestry Department of the Government of Thailand
- Attended virtual 5th World Congress on Agroforestry, Quebec City, Canada during July 17-20, 2022

ANDUAT,AYODHYA

- Received **Best Teacher Award** by the A.N.D.U.A.&T., Kumarganj, Ayodhya on 05 September, 2021.

OUAT, BHUBANESHWAR

- **Third Best photography award to** Dr. S. C. Mohapatra, Prof. & OIC,AICRP-AF organised by ICAR-CAFRI through online mode.
- "**Excellence in Research Award**" in the field of Horticulture to Mrs. Sasmita Behera, Junior Scientist (Horticulture), AICRP on Agroforestry from Society for Scientific Development in Agriculture & Technology In:

International web conference on Global Research initiative of Sustainable agriculture & allied Sciences (GRISSAS-2021) 13-15th Dec 2021.

- "**Distinguished Scientist Award**" in the field of Agroforestry to Mrs. Sasmita Behera, Junior Scientist (Horticulture), AICRP on agroforestry during two days 4th National conference on" Doubling Farmers income for Sustainable 7 Harmonious agriculture (DISHA-2021) 13-14th March at Dhanbad, Jharkhand.

BAU, RANCHI

Dr. M.S. Malik, Officer In-charge, AICRP on Agroforestry and Dean Faulty of Forestry got National Award "ICAR Fakhruddin Ali Ahmad Award" for Outstanding Research in Tribal Farming Systems, 2021 on 94th ICAR Foundation Day & Award Ceremony, 16th July 2022 at New Delhi.

CCSHAU, HISAR

- Dr. Chhavi Sirohi, Assistant Scientist has received Indian Society of Agroforestry-Best Paper Award published in *Indian Journal of Agroforestry* for the year 2021.
- Dr. Chhavi Sirohi, Assistant Scientist received First Prize in photography competition organised by ICAR-CAFRI through online mode
- Dr. Chhavi Sirohi, Assistant Scientist has received General Support Grant to participate 5th World Congress on Agroforestry: Transitioning to a Viable World to be held on July 17th-20th, 2022, in Québec City, Canada.
- Blog of Dr. Chhavi Sirohi, Assistant Scientist and coauthors selected in Top 10 Blogs in the Blog Competition organized by the XV World Forestry Congress hosted by the Government of the Republic of Korea from 2nd to 6th May 2022.

SDAU, SK NAGAR

- Lalita Saini (2022) honoured by an award of "The Young Scientist Award" by Vigyanvarta excellence award 2022, vigyanvarta, An International e-magazine for science enthusiasts in collaboration with Omm shanti Narayan Foundation Trust.

JNKVV, JABALPUR

- Dr. S.B. Agrawal, Scientist of year Award 2021 (Society for Scientific Development in Agriculture and Technology).

TNAU, FCRI, METTUPALAYAM

- Two Awards

TANUVAS, IAN, KATTUPAKKAM

- Dr. V.S. Mynavathi and Dr. S. Gunasekaran received II prize in the photography competition held on the theme of Agroforestry organized by Central Agroforestry Research Institute, Jhansi.

UAS, BANGALORE

- Dr. Hanumanthappa, D.C., Mr. Bhaskar, V. and Mr. Ganesha, B.H. secured award for "Best Agroforestry based Integrated Farming System Demonstration" awarded by University of Agricultural Sciences, GKVK, Bangalore on 14.11.2021.

KAU, THRISSUR

- Received best poster award for the paper "Shade tolerance, yield and nutritive value of selected cereal and grass fodders in a typical homegarden of Central Kerala", presented in the International seminar on ' 'Sustainable urban agricultural system and community resilient cities' held in hybrid mode on 22/03/2022, at College of Agriculture, Vellayani, Kerala.

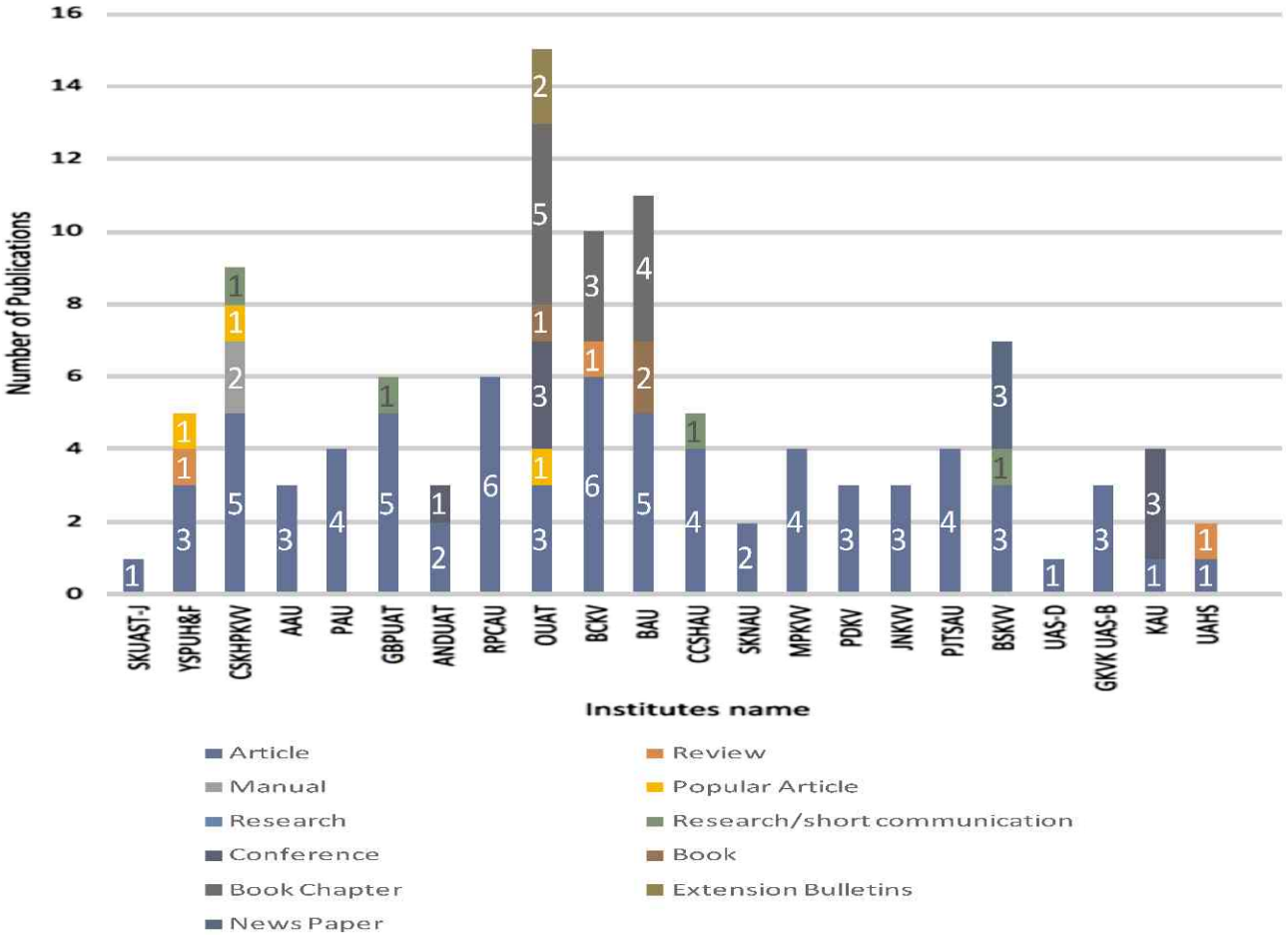
UAHS, COF, PONNAMPET

- Dr. Ramakrishna Hegde, Professor and OIC has been identified as External Expert Group member for the evaluation of All India Coordinated Research Projects under Indian Council of Forestry Research and Education, Dehradun.

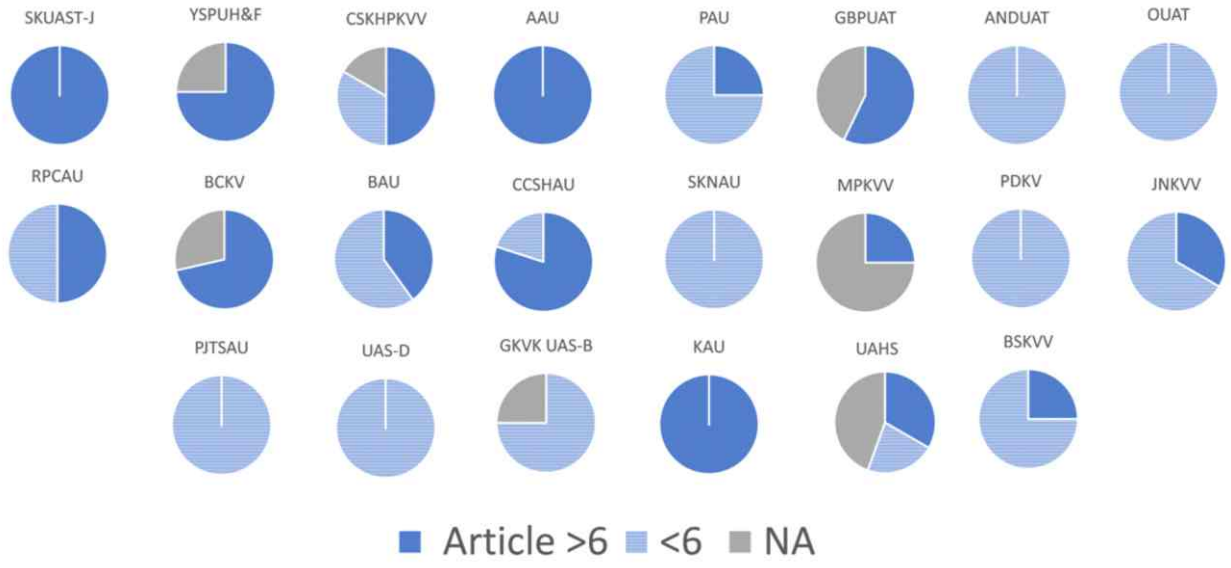
BSKKV, DAPOLI

Recipient of "Nirmalakrishna Award" instituted by Dr. BSKKV, Dapoli University by Dr. Nandkishor A. Meshram on the occasion of University foundation on day 18th May 2022 at Dr. BSKKV, Dapoli as a best research and research paper presentation of the University.

6. Research Publications



Summary of publications for the year 2021-2022



Scientific articles published in journals sorted based on NAAS rating

7. Budget (Centre wise head-wise break up for 2020-21)

Name of centres	Pay allow.	T.A	Rec. Cont	IT	TSP	SCSP Gen.	SCSP Cap.	Total
OUAT, Bhubaneshwar	29.00	0.30	5.75	0.75	2.00	1.25	0.00	39.05
TNAU, FCRI, Mettupalaym	25.00	0.30	5.75	0.75	0.00	1.45	0.75	34.00
BSKKV, Dapoli	50.00	0.30	5.25	0.75	0.00	1.50	0.75	58.55
UAS, Dharwad	72.00	0.30	5.50	0.75	0.00	1.50	0.63	80.68
ANDUAT, Ayodhaya	15.00	0.30	4.50	0.00	0.00	0.00	0.00	19.80
SKNAU, ARS, Fatehpur-Shekhawati	28.00	0.30	5.00	0.75	0.00	0.00	0.00	34.05
CCSHAU, Hisar	27.00	0.20	5.35	0.75	0.00	0.00	0.00	33.30
PJTSAU, Hyderabad	60.00	0.30	5.25	0.75	0.00	1.25	0.00	67.55
JNKVV, Jabalpur	67.00	0.30	4.50	0.00	0.00	1.25	0.00	73.05
TANUVAS, IAN, Kattaupakkam	27.00	0.30	5.75	0.75	0.00	1.50	0.75	36.05
PAU, Ludhiana	45.00	0.30	5.50	0.75	0.00	0.00	0.00	51.55
AAU, HRS, Kahikuchi	30.00	0.20	6.55	0.00	3.00	0.00	0.00	39.75
PDKV, COA, Nagpur	45.00	0.30	5.50	0.75	0.00	1.50	0.00	53.05
GBPUA&T, Pantnagar	45.00	0.30	5.00	0.75	0.00	1.50	0.00	52.55
RAU, Pusa	0.00	0.30	3.50	0.00	0.00	0.00	0.00	3.80
MPKV, Rahuri	39.00	0.30	5.25	0.75	0.00	0.00	0.00	45.30
BAU, Ranchi	25.00	0.30	4.00	0.75	2.00	0.00	0.00	32.05
SDAU, SK Nagar	25.00	0.30	5.50	0.75	0.00	0.86	0.50	32.91
YSPUH&F, Solan	35.00	0.30	5.25	0.75	0.00	0.00	0.00	41.30
SKUAST-K, Srinagar	54.00	0.40	5.75	0.75	2.50	0.00	0.00	63.40
KAU, Thrissur	49.00	0.30	5.50	0.75	0.00	0.00	0.00	55.55
BCKVV, RRS, Jhargram	44.00	0.30	5.75	0.75	2.00	1.00	0.00	53.80
UAS, Bangaluru	52.00	0.30	5.75	0.75	2.00	1.00	0.75	62.55
CSKHPKV, Palampur	64.00	0.50	6.25	0.75	2.61	2.00	0.75	76.86
UAHS, COF, Ponnampet	0.00	0.00	2.00	0.00	0.00	0.00	0.00	2.00
SKUAST-J, Jammu	0.00	0.00	2.00	0.00	1.00	0.00	0.00	3.00
PC Unit	0.00	2.00	6.06	0.29	0.00	0.00	0.00	5.79
Total	952.00	9.30	137.71	14.76	17.11	17.56	4.88	1153.85

8. Staff Strength

Sl.No.	Name of the centre	Scientist (02 at each centre)	Tech.	Supp Staff	Total
1	OUAT, Bhubaneshwar	Dr. S.C. Mohapatra and Mrs. Sasmita Behera	1	2	5
2	TNAU, FCRI, Mettupalaym	Dr. Jude Sudhagar and Dr. K. Ramah	1	2	5
3	BSKKV, Dapoli	Dr. Suchitra S. Desai and Dr. N.A. Meshram	1	1	4
4	UAS, Dharwad	Dr. Raju L. Chavan and Dr. S.T. Hundekar	1	2	5
5	ANDUAT, Ayodhya	Dr. S.K. Verma and Vacant	1	1	4
6	SKNAU, ARS, Fatehpur-Shekhawati	Dr. Dharmendra Tripathi and Sh. Ramu Meena	1	2	5
7	CCSHAU, Hisar	Dr Chhavi Sirohi and Vacant	1	1	4
8	PJTSAU, Hyderabad	Dr. A.V. Ramanjaneyulu and Dr. T. Chaitanya	1	1	4
9	JNKVV, Jabalpur	Dr. S.B. Agarwal and Shri Yashpal Singh	1	1	4
10	TANUVAS, IAN, Kattaupakkam	Dr. S. Gunasekaran and Dr. V.S. Mynavathi	1	1	4
11	PAU, Ludhiana	Dr. R.I.S. Gill and Dr. Navneet Kaur	1	1	4
12	AAU, HRS, Kahikuchi	Ms. R. Bezbaruah and Dr. Kaberi Mahanta	1	1	4
13	PDKV, COF, Nagpur	Dr. V.M. Ilorkar and Dr. P.D. Raut	1	1	4
14	GBPUA&T, Pantnagar	Dr. S.K. Lavania and Dr. Ashutosh Dubey	1	2	5
15	MPKV, Rahuri	Dr. B.R. Najan and Dr. R.H.Kolse	1	1	4
16	BAU, Ranchi	Dr. M.S. Malik and Dr. P.R. Oraon	1	1	4
17	SDAU, SK Nagar	Dr. J.R. Jat and Dr. A.G. Patel	1	2	5
18	YSPUH&F, Solan	Dr. D.R. Bhardwaj and Sh. Krishan Chand	1	2	5
19	SKUAST-K, Srinagar	Dr. G.M. Bhat and Dr. Megna Rashid	1	2	5
20	KAU, Thrissur	Dr. V. Jamaludheen and Dr. Asha K. Raj	1	2	5
21	BCKVV, HRS, Jhargram	Dr. Benukar Biswas and Dr. Subhabrata Panda	1	2	5
22	GKVK, UAS, Bangaluru	Mr. Bhaskar, V. and Dr. Hanumanthappa, D.C.	1	1	4
23	CSKHPKV, Palampur	Dr. Punam and Dr. Rameshwar	1	1	4
	Toatl sanctioned	46 (44 in position)	23	33	102

9. Directory of Key Personnel

S.No.	Name	AICRP-Agroforestry Secretariat/Centre	Email	Mobile
1.	Dr. A. Arunachalam	Director, ICAR-CAFRI & Project Coordinator, AICRP-Agroforestry	pc.aicrpaf@gmail.com director.cafri@icar.gov.in	09412441230
2.	Dr. A.K. Handa	Nodal Scientist, PC Unit	aicrpagroforestry@gmail.com Arun.Handa@icar.gov.in	09415179658
3.	Mr. Suresh Ramanan S.	Associate Scientist, PC Unit	suresh.s@icar.gov.in	09149587827
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7.	Dr. V. Bhaskar	GKVK, UAS, Bengaluru	bhaskaragroforestry@gmail.com	09448985523
8.	Dr. G.M. Bhat	SKUAST-K, Srinagar	bhatm67@gmail.com	09797832690
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13.	Dr. Ashutosh Dubey	GBPUAT, Pantnagar	ashutoshdubeyaf@gmail.com	09412381277
14.	Dr. R.I.S.Gill	PAU, Ludhiana	rishigill@pau.edu	08146600670
15.	Dr. Gunasekaran	TANUVAS, IAN, Kattupakkam	gunaj2@gmail.com	09444477155
16.	Dr. Ramakrishna Hegde	UAHS, COF, Ponnampet,	vanasiri03@gmail.com	09448312978
17.	Dr. V.M. Ilorkar	PDKV, COA, Nagpur	ilorkar@yahoo.co.in	09422831053
18.	Dr. V. Jamaludheen	KAU, Thrissur	jamaludheen.v@kau.in	09447271867
19.	Dr. A.V. Ramanjaneyulu	PJTSAU, Hyderabad	anumularaman2022@gmail.com	09441312264
20.	Dr. M.S. Malik	BAU, Ranchi	mohdshujamalik@yahoo.com	09934582241
21.	Dr. S.C. Mohapatra	OUAT, Bhubaneswar	Scmohapatra19765@gmail.com	09437464682
22.	Dr. Bhimaraj Rangnath Najan	MPKVV, Rahuri	Bhimaraj.najan@rediffmail.com	08806282240
23.	Dr. A.G. Patel	SDAU, SK Nagar	rsagroforestry@sdau.edu.in	09429029595
24.	Dr. Punam	CSKHPKVV, Palampur	profpunam@gmail.com	09816366664
25.	Dr. Sandeep Sehgal	SKUAST-J, Jammu	sehgals1@yahoo.com	09419109684
26.	Dr. Chhavi Sirohi	CCSHAU, Hisar	chhavisirohi22dec@gmail.com	09050547849
27.	Dr. Jude Sudhagar	TNAU, FCRI, Mettupalaym	judesudhagar@rediffmail.com	09790293293
28.	Dr. Dharmendra Tripathi	SKNAU, ARS, Fatehpur-Shekhawati	dhtrepathi@gmail.com	09680355511
29.	Dr. Sanjay Verma	ANDUAT, Ayodhaya	ver.sanj@gmail.com	07408006003

Swachh Bharat Abhiyan

स्वच्छ भारत

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