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Agroforestry systems in selected villages of Milkipur block in Ayodhya district in Uttar Pradesh

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Abstract
Agroforestry systems shows greater diversity among village's on farm production of various crops, trees, shrubs, vegetables, medicinal plants on the same field. Current Investigation shows literacy rate of farmers and their family become gradually increasing (82%) in this block. Major domesticated animals are cow and buffalo. Milk production enhanced extra income of various categories of farmer's. Systems of agroforestry provide opportunity to deliver multiple output from per unit area of land. Present study revealed combination of tree and crops may easily cultivated on any kind of land on given areas and most dominated system is agri-silviculture which is most probably adopted by the farmers (80%) another systems such as silvi-pasture (10%), agri-silvi-pasture (8%) respectively. Dominant trees species are *Eucalyptus species, Tectona grandis, Dalbergia sissoo, Acacia nilotica and Mangifera indica, Psydium guajava, Emblica officinalis* are common fruit species. We had identified production potential of various field crops under tree and fruit trees. It given better response but on an average 10% losses of yield of arable crops through interaction of trees from above and below the ground. Hence, Agroforestry systems gives better response in terms of increasing tree cover to fulfill the criteria of 33% forest area recorded to (1988, National forest policy) needed for any geographical area of the country.

Keywords: Agroforestry systems, interaction, arable crops, multiple outputs

Introduction
Agroforestry is a dynamic, ecologically based natural resource management system that, through which the integration of trees/ woody perennials in farm and rangelands, diversifies and sustains production for increased social, economic and environmental benefits. Agroforestry systems in India include trees in forms, community forestry and variety of local forest management and ethno – forestry practices. In Uttar Pradesh agroforestry practices vary according to different agro-climatic zones, land capability and socio- economic status of farmers. Indian agriculture faces diverse challenges and constraint due to growing demographic pressure, increasing food, feed and fodder needs, natural resource degradation and climate change (Dhyani *et al.,* 2013) [2] The variation is reflected in terms of diversity in agroforestry practices and comparative advantage prompted a renewed interest to harness the vivid potential (Verma *et al.* 2017) [11]. The survey is based upon the potential of components of agroforestry for goods and service of mankind. It also not only fulfill the demand of various products as well as provides greater opportunity for employment in our country. Agroforestry is initiative tool which provides excess amount of food and raw materials for forest based industries such as, plywood, paper industry, playing goods industry, confectionery industry and textile industry. In India approximately 60% population is totally depend upon agriculture and allied activities. Now agroforestry play key role for gradually increasing population and shrinking land resources so, it provides multiple commodities for benefit to the farmers. The survey revealed the wide spectral potential of agroforestry practices in sustenance of agriculture as they provide food, fodder, fruit, vegetables, fuel wood, timber, medicines, fiber etc. from the same piece of land at a time which not only fulfill the demand of people but also elevate their socio-economic status and standard of life (Pathak *et al.,* 2000) [5]. Systems of agroforestry have been conserved natural resources in terms of biodiversity and mitigating climate change.

Material and Methods
The present investigation was carried out from among villages of Milkipur block of Ayodhya district. According to the interview of farmers shows different patterns of cropping system followed by respective farmers in terms of Agroforestry systems. Selection procedure was

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carried out by presence of various tree species on the farm association of commercial crops.

The following steps had been taken for observation in whole bock

1. Geographical locations of this block: Milkipur is a town and tehsil in Faizabad district (now Ayodhya district) in the Indian state of Uttar Pradesh. Milkipur is 33 km south of district headquarters of Ayodhya city. Milkipur is located at 26.594375°N 81.909554°E. It has an average elevation of 94 meters (311 feet). The Milkipur Constituency is surrounded by Gomti and Tamsa rivers.
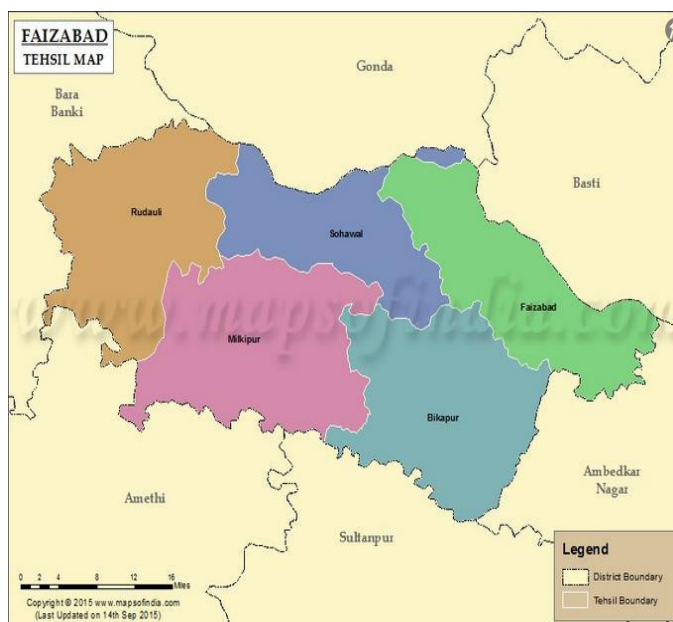
Map of Milkipur Block Ayodhya

2. Selection of Block: Out of 11 blocks of Ayodhya district Milkipur one of them Acharaya Narendra Dev University of Agriculture and Technology is situated at Kumarganj (a town situated at a distance of about 10 km, south from Milkipur). Tehsil headquarters and Police station of Milkipur tehsil are situated at Inayatnagar, 5 kilometers North-East from Milkipurcentre.

3. Literacy rate of farmers in this block: Among the villages of this block has been selected various category of farmers and his family members on the basis of metric pass and age become 18 & above. Therefore literacy rate equal to number of selected various category of farmers and own family members / total no. of farmers along with family members for study X 100. Such formula release the literacy rate of any kind of area.

4. Selection of villages: Selection of villages was based upon presence of variety of forest and fruit tree species and adoption of following agroforestry pattern or boundary plantation association with various field crops. There are various villages and his name, Nisaru Bariya, Charkawa Upadhyay, Asthna, Ratnapur, Pure Benidatt pandey ka purwa, Shukul purwa, Joriyam, Bhartpurva etc. It has been randomly selected on the basis of plenty amount of trees and shrubs on farm.

5. Selection of farmers: Forty farmers had selected on the basis of their landholdings. It has been categorized into four parts such as Marginal farmer (<1 hectare), Small farmer (1-2 hectare), Medium farmer (2-4 hectare), and Large farmer (>4 hectare).Selection procedure of farmers also based upon following agroforestry systems.

6. Appraisal of Existing agroforestry systems: Accordingto Allocation of question on their criteria has been implemented and identifying best way to out came various agroforestry systems such as, agri-silvi-culture system (Trees + crops), sivi-pastoral system (Trees + pasture), agri-silvi-pastoral system (Tree + crop + pasture) etc.

7. Domesticated animals, milk yield and fodder production: Current investigation shows livestock size of domesticated animals such as Cow, Buffalo etc. Average no. of cattle has been calculated by number of cattle cow or buffalo have various category of farmers / total number of selected farmers for study. Same technique has been applied for the estimation of average milk production by the farmers of given block. Barseem, Maize, Jwar, Bajra has been produced by farmers of this block in huge amount for feed of cattle.

8. Associated crops grown under the canopy of various tree species: Any agroforestry systems does not complete without presence of arable crops. On the basis of spatial and temporal arrangement of trees and crops it has been followed various patterns such as Tree + crop, Fruit trees + vegetables, fruit trees + crops, perennial trees + pastures and tree on the boundary from one side or two side.

9. Dominance agroforestry system and commercial crop: Agri-silvi-culture system comes under dominant category in comparison to another agroforestry systems in given study area. Present study revealed agriculture crops under main category in associated to trees. Various agronomical crops grown under the trees eg. Wheat, paddy, urd, sugercane, potato, pea, mustard etc. and fodder crops eg. barseem, jwar, bajra, maize etc.

10. Area under agroforestry systems: In this block, Most of the farmers adopted agroforestry practices from 75 to 80% area consumed for intercropping purposes. Majority of farmers produce trees on boundaries, scattered trees in the

field, fruit trees and shrubs on agricultural land. Few farmers grown single species of forest grown fast growing tree species on the field such as, *Eucalyptus* spp. (Safeda) and *Tectona grandis* (Sagwan).

Result and Discussion

The present investigation is based upon Existing agroforestry systems and production potentials of various field crops under trees species. Identity mutualism among crops and trees. Combination of trees varies according to species to species it compete with crops under and above the ground for sunlight, nutrition, moisture, humidity and air. In few cases shows allopathic effect on the crop.

Socio-economic status of Milkipur block: Present survey revealed that literacy rate of among farmers and their family of different villages in Milkipur block. Observation shows high literacy rate (Metric pass) of large farmers category (>92%) in comparison to marginal (60-75%) and small farmers (75-80%). Low literacy rate revealed in marginal category farmers (Table 1and Fig. 1). After to physical interview of farmers having various animals for domesticated by farmers for milk yield (Major) and its by produces such as dung, cow urine etc. cow and buffalo are majority of animals adopted by the farmers from marginal to large in respective numbers in mean (1.7 and2.0) shows (Table 2 and Fig. 2). In highest no of buffaloes domesticated by large farmers in comparison to marginal and small farmers. In this scenario cow is highly priorities animal for milk production in all categories of farmers in this block. Milk production becomes highest from buffalo (20 litre/ day) in comparison to cow (11 litre / Day) in given table (Table 3 and fig. 3) and minimum by marginal farmers cow and buffalo respectively (3.5 and 6 litre / day). The marginal, small, medium and large farmers of certain villages in Baldirai block, Sultanpur district have devoted approximately 28-74% area of the total land of various agroforestry systems (Maurya *et al.*, 2018) [4].

Existing agroforestry systems in various villages of Milkipur Block: The present study revealed status of Agroforestry systems in various villages in Milkipur block but overall study shows dominant pattern is agri-silviculture system and predominantly agri-horti system (fruits + crop). Highest area under agroforestry hairing large farmers 41.27 percent in comparison to marginal and small farmers is given in Table 3. In Nisaru bariy a village, maximum farmers using agri-silviculture system. Intercropping patterns followed by various categories of farmers but most predominantly, safeda + paddy and safeda + wheat in whole block of Milkipur in comparison to other tree species. Large farmers grown fruits (mango & guava) through scattered trees combined with crops in comparison to marginal, small and medium farmers. Teak with paddy as well as sole plantations has been practiced in agroforestry in ayodhya district (Sharma *et al* 2011) [7]. The dominant tree species has *Eucalyptus* hybrid, *Tectona grandis, Dalbergia sissoo*. Predominant fruit species become, *Mangifera indica, Emblica officinalis, Psidium guajava* etc. during boundary planting of forest trees no shade effect had been observed during initial stage of planting. When tree attain its sufficient height and girth it deplete the yield potential of crop due to shade and nutrient competition with the commercial crops (wheat, paddy, mustard etc). According to Shukla *et al.* 2020 [8], the patterns of plantation on bunds and blocks of Baldirai was observed 17.94% and 16.82%

respectively. Silvi-horti system practiced in Ratnapur village farmers. There are many fruits grown in large scale with trees on the boundary for protection as wind breaks. There are two main cropping seasons in the state, viz. rabi and kharif. The kharif cropping season starts from July to October during the south west monsoon. Paddy, maize, jowar, bajra, pulses (arhar, black gram, green gram), potato, cotton, groundnut and soybean are the various crops grown in the kharif season. Rabi cropping season starts from october to march, and the important rabi crops are wheat, barley, peas, chickpea and mustard. Zaid season is between kharif and rabiand the major crops grown during this season include watermelon, muskmelon, cucumber and vegetables. Agri-silviculture system (80%) existing in this block and followed by another systems Silvi-pasture (10%), Agri-silvi-pasture (8%) and other system (Table 07 and fig. 05) respectively. Agroforestry is lagging practiced in eastern Uttar Pradesh in comparison to western Uttar Pradesh the less availability of land for farmers, poor technical knowledge about plantation and sale (Srivastav, *et al.* 2015) [9].

Production potentials of various field crops under perennial trees

Agroforestry occupies ~25.32 million hectare (mha) or 8.2% of the total geographical area in India (Dhyani *et al.* 2013) [2]. The farmers have greater opportunity to group various agronomical, horticultural crops under the trees. Present study shows yield variations under the trees shows in (Table 7). During intercropping of various crops under perennial trees losses little bit yield potential approximately 10-25% loss may observed. It varies on the basis of proper management practices. Therefore, a management system needs to be devised that is capable of producing food from marginal land and is also capable of maintaining and improving quality of producing environment. *Eucalyptus tereticornis* based agri-silvicultural system, age of plantation six years Paddy grain yield was found to be 14.7-19.7% less under agroforestry system and wheat yield grain was 26.4–34.6% lower than open cultivation (Verma, *et al.* 2014) [10]. It has given in pie chart shows produced quental / hectare.

Conclusion

The different combinations of agroforestry systems were recorded in the studied areas and among villages existing practices were beneficial for enhance income generation of farmers. The training, gosthies and visit programs should be organized by Government authorities such as forest department, University forestry / agroforestry transfer of technology to villages and cash transfer for purchasing seedlings & planting trees. Free availability of seedlings to promote tree plantation. Need for commercial and private nurseries for production of various trees species. Farmers should have alternative option to select superior trees / fruit for multiple benefits. MPTs trees would be required for multiple outputs and fodder production for livestock. Marketing or sale of trees, transit and felling permit to be issued by forest department & may facilitate transition of wood lots. Agri-silviculture system follow huge amount of farmers from under various categories. Safeda tree used in large scale for boundary plantation. Most of farmers has been included multiple use of trees in terms of furniture, pole for making agricultural equipment's and fuel wood purposes. Agroforestry practices enhanced gross income of farmers in comparison to mono-cropping it is alternate option to fulfill

wood demands for local level. Such integration reduces the dependency on Natural, protected and reserved forests. Above statements may helpful for implementation of rules of agroforestry policy in these locations and mitigate the risk of failure by intercropping of various crops under trees.

Table 1: Educational status (Metric pass) of farmer and their family

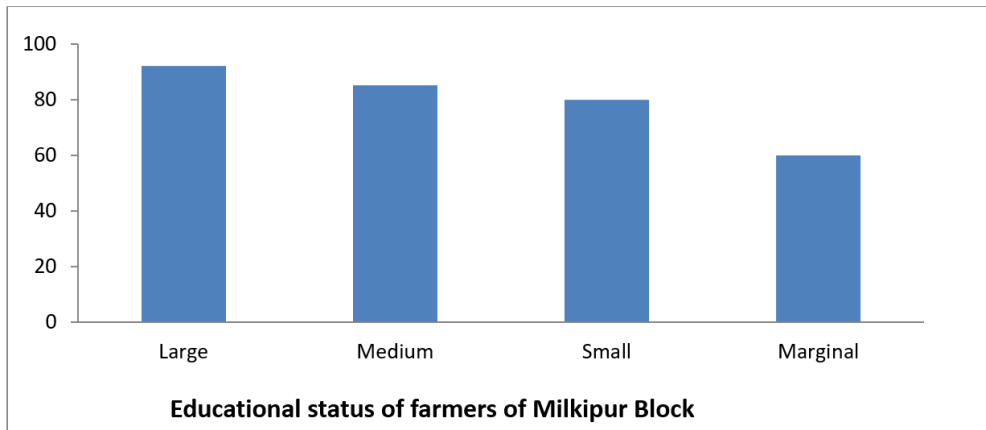| Milkipur Block	
Educational	**Status of Farmers**
Large	>92%
Medium	85-90%
Small	75-80%
Marginal	60-75%

Fig 1: Educational status of farmers of Milkipur block.

Table 2: Live stock size and milk yield in Milkipur block

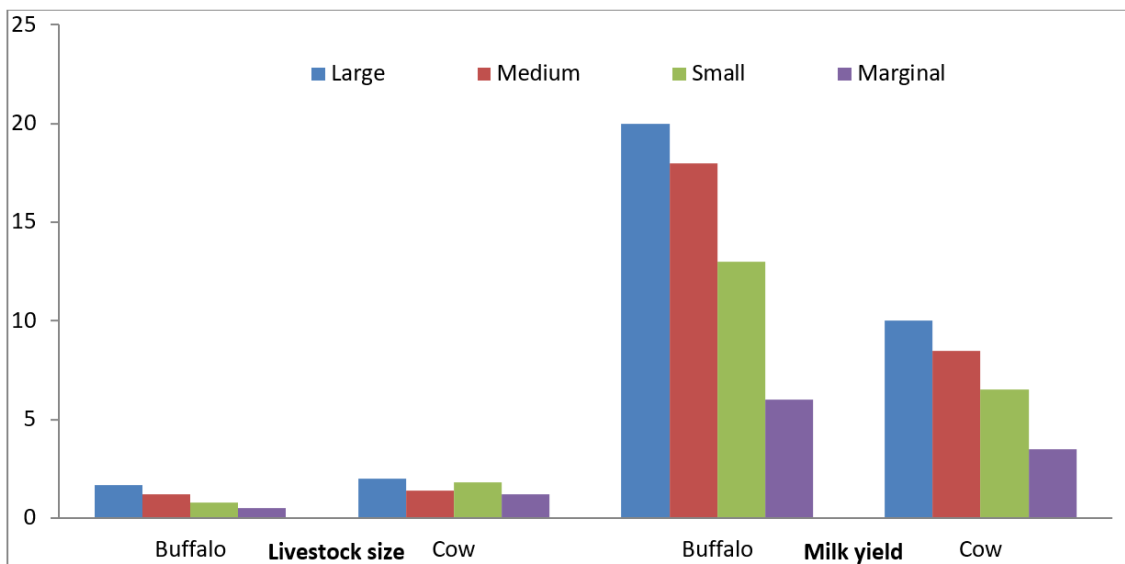| Category of Farmer	Livestock size (No.)		Milk yield (litres)	
	Buffalo	**Cow**	**Buffalo**	**Cow**
Large	1.7	2.0	20	10
Medium	1.2	1.4	18	8.5
Small	0.8	1.8	13	6.5
Marginal	0.5	1.2	6	3.5

Fig 2: Livestock size and milk yield (liter) of various categories of farmer

Table 3: Area under agroforestry system in Milkipur block (Average across farmers)

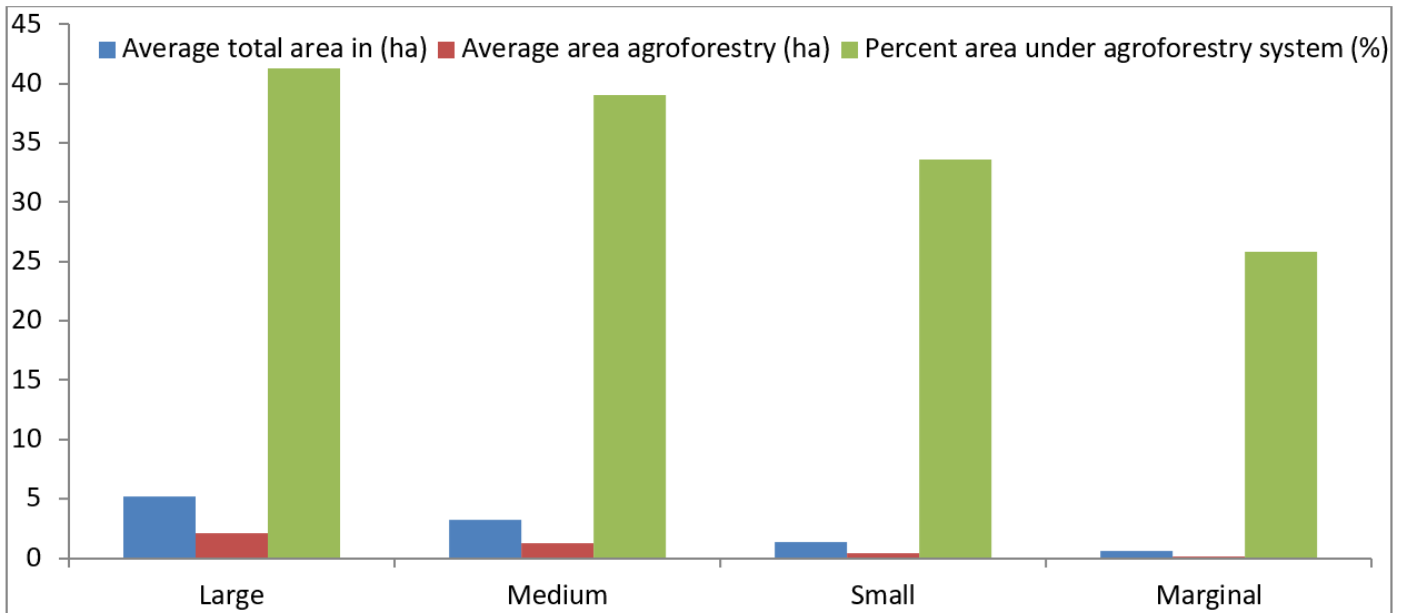| Category of farmer	Average total area in (ha)	Average area agroforestry (ha)	Percent area under agroforestry system (%)
Large	5.21	2.12	41.27
Medium	3.26	1.28	39.00
Small	1.34	0.45	33.58
Marginal	0.58	0.15	25.86

Fig 3: Area under agroforestry system in Milkipur block (Average across farmers)

Table 4: Agroforestry systems and tree + crop species of Milkipur Block

Farmers Category	Agroforestry systems	Tree+Crops
Large	Agri-silviculture, silvi-pasture system and agrihorti system	Safeda+Paddy, Teak+Paddy, Papaya+Vegetable, Mango+Wheat, Mango+Paddy etc.
Medium	Agri-silviculture, silvi-pasture, agri-silv-horti system	Safeda+Paddy, Safeda+Wheat, Teak+Mustard
Small	Agri-silviculture, agri-horti system	Safeda+Urd, Safeda+Paddy, Safeda+Wheat
Marginal	Agri-silviculture system	Teak+Paddy, Teak+Wheat

Table 5: Forest tree and fruit species of Milkipur Block

Farmers Category	Forest Tree species	Fruit species
Large	Safeda, Teak, Shisham	Mango, Papaya, Ber, Karonda, Guava etc.
Medium	Safeda, Teak, Mulberry, Arjun	Mango, Guava, Lemon, Malberry, Banana
Small	Eucalyptus, Mahua, Teak	Mango, Guava, Aonla, Ber
Marginal	Safeda, Teak	Papaya, Ber, Lemon

Table 6: Category of field crops/seasonal crops growing by farmers of Milkipur block

Farmers Category	Season			Fodder crops
	Kharif	Rabi	Zaid	
Large	Paddy, Urd, Sugarcane	Wheat, Mustard, Pea, Gram etc.	Urd, Moong	Barseem, karvi, maize, jwar, bajara
Medium	Paddy, Maize	Wheat, Potato	Urd, Moong	Barseem, karvi, maize, jwar
Small	Paddy, Arhar	Wheat, Pea, Mustard	-	Barseem, karvi, maize, jwar
Marginal	Paddy	Gram, Wheat	-	Barseem

Table 7: Performance of crop (yield) under the canopy of various tree species and prevalent agroforestry systems in Milkipur block.

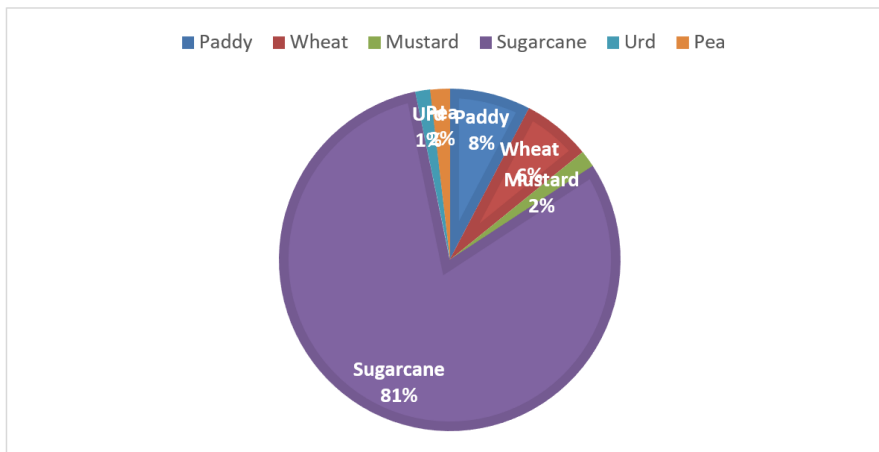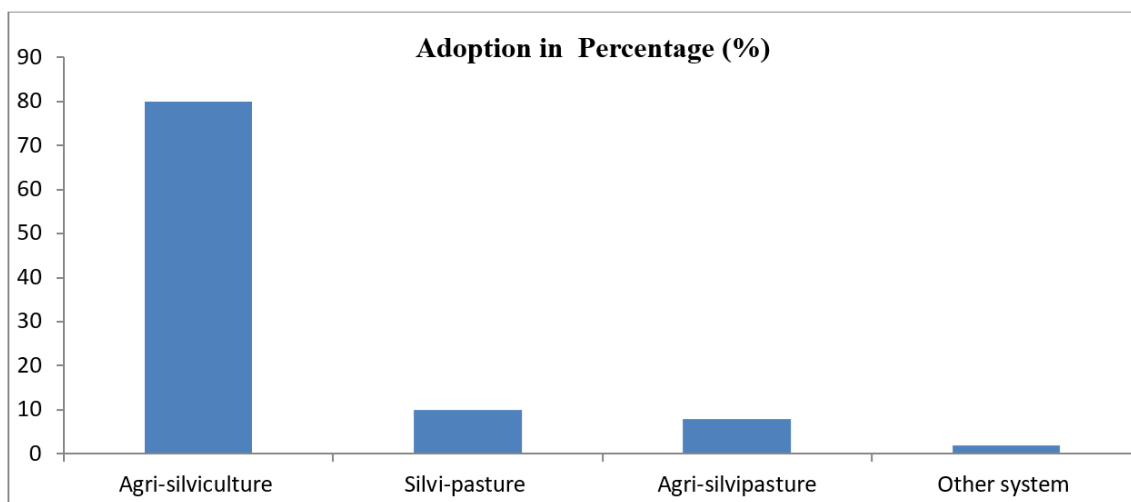| Milkipur Block		Systems of Agroforestry	Adoption in Percentage (%)
Crop	Yield (q/ha)		
Paddy	38	Agri-silviculture	80
Wheat	32	Silvi-pasture	10
Mustard	08	Agri-silvipasture	08
Sugarcane	400	Other system	02
Urd	7		
Pea	9		

Fig 4: Crop production potential (q./ha)

Fig 5: Existing prevalent agroforestry systems in Milkipur Block

Reference
1. Anonymous. National Forest Policy. MoEF & CC, GOI, New Delhi, 1988.
2. Dhyani SK, Handa AK, Uma. Area under agroforestry in India: An assessment for present status and future perspective. Indian Journal of Agroforestry. 2013;15:1-11.
3. Dobriyal MJR. Agroforestry practices for non- wood forest products and rural development. In: Agroforestry: Theory and practices (eds.) AJ Raj and SB Lal. Scientific Publishers, India, 2014, 540.
4. Maurya MK, Parihar AKS, MAurya R. Survey of existing agroforestry systems and identify different fruit/ forest crop grown under agroforestry in selected villages of Baldirai block in Sultanpur district. Ind. Jr. Pure. Appl. Bioscience. 2018;6(6):20-24.
5. Pathak PS, Pateria HM, Solanki KR. Agroforestry systems in India A diagnosis and design approach. All India Coordinated Research Project on Agroforestry. National Research Center for Agroforestry, Jhansi, India, 2000.
6. Rizvi RH, Dhyani SK, Ram Newaj, Saxena A, Karmakar PS. Indian Journal of Agroforestry. 2013;15(2):26-30.
7. Sharma A, Singh RP, Saxena AK. Growth and mineral nutrition of teak (*Tectona grandis* Linn. F.) in sole and rice based agroforestry plantations in sodic soils of eastern Uttar Pradesh, India. Plant Arch. 2011;11(1):79-81.

8. Shukla H, Tomar A, Kushwaha A, Singh R, Srivastava A. Agroforestry practices in Ballia district of eastern plain region of Uttar Pradesh, India. Intl. Jr. Envtl. & Ag. Res., (IJOEAR). 2020;6(1):72-80.
9. Srivastava A, Tomar A, Dubey K. Agroforestry in eastern Uttar Pradesh. Van. Sangyan. 2015;2(10):17-22.
10. Verma SK, Rana BS. Effect of light intensity on paddy and wheat grain yield under *Eucalyptus tereticornis* Sm. basedagri-silvicultural system. Indian For. 2014;140(1):23-28.
11. Verma P, Bijalwan A, Dobriyal MJR, Swamy SL, Thakur TK. A paradigm shift in agroforestry practices in Uttar Pradesh, Current Sci. 2017;112(3):509-516.