



Review Article

Agroforestry for income stabilisation of dryland farmer

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Abstract : The economic evaluation of different tree based cropping was assessed under different levels of economic status of the farmers in dry lands under two categories viz., 1) Income stability for poor and marginal farmers 2) Economic gain system for medium dry land farmers. Inclusion of nitrogen fixing tree species like *Faidherbia albida* (African babul), *Hardwickia binata* (Yepi) etc. would cause improvement in soil fertility and increase in crop productivity especially benefiting the poor and marginal farmers. The study conducted in *Faidherbia albida* based cropping system, the yield and returns from crops (maize+soybean and maize+field bean) were improved to maximum extent when grown in association with trees compared to respective sole crops because of the complementary effects of *Faidherbia albida*. Studies carried out in *Hardwickia binata* based alley cropping revealed that yields and monetary returns were higher in sunflower crop when grown as intercrop in pollarded trees of *Hardwickia* than grown in unpollarded trees. The improvement in yield and returns is mainly due to abundant availability of light to sunflower crop grown underneath because of removal of crown. The benefic cost ratio was also increased when sunflower was intercropped in pollarded trees. It was clearly evident that in both the tree based cropping systems, the returns from the system (both from trees and crops) were maximum when compared to sole cropping systems. Benefit cost ratio was doubled in tree based cropping system. Agrihorticultural system is considered to be economic gain system especially for the dryland farmers who afford to take cost investment for maintenance of fruit trees being a commercial component in the system. In a study with ber based agrihorticultural system, it was observed that though the ber trees affected the growth and yield of sunflower crop when grown as intercrop resulting reduced monetary returns from the crop, but the overall combined monetary returns were increased by 145 per cent in intercropping of soybean in guava and by 48 per cent in intercropping of soybean in curry leaf over sole cropping of soybean. Benefit cost ratio was also substantially high in both agrihorticultural systems. Thus the agroforestry, a version of tree cum crop farming practices would benefit the poor and marginal farmers to improve their economic status especially in semi arid tropic areas.

Key Words : Agroforestry, Income stability, Dryland farmer

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Drylands constitute about 72 per cent of the total cropped area of 142 mha in the country contributing about 42 per cent of total food production. Crop production in drylands is risky, uncertain and uneconomical because of vagaries of monsoon.

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For imparting stability and providing sustainability to the farming system, specially in drylands, a tree cum crop farming system will be one of the most appropriate and alternate land use system matching the land capability. It mainly aims at generation of assured income with minimum risk through efficient utilization of available resources. Various options are now available to the dryland farmers to choose a system matching his land capabilities, meeting the needs of the farmer, stabilizing the income of the farmer etc. Keeping in view the importance of agroforestry specially in drylands, the economic evaluation of different tree based cropping systems were assessed under different levels of economic status of the farmers

in drylands.

Income stability for poor and marginal farmers:

Agrisilviculture encourages multiple land uses besides providing the farmer with extra income from sale of wood products. One of the reasons for enhanced interest in agrisilviculture system for possible adoption by resource poor farmers of the tropics is the belief that inclusion of desirable woody perennials specially nitrogen fixing tree's would cause improvement in soil fertility. Inclusion of nitrogen fixing tree species like *Faidherbia albida* (African babul), *Leucaena leucocephala* (Subabul), *Dalbergia sissoo* (Sisham), *Hardwickia binata* (Yepi) etc., would help both for imparting stability of income and providing sustainability by replacing the traditional farming practices in dry lands.

Faidherbia albida based agrisilviculture system:

From the study conducted in *Faidherbia albida* based cropping system, (Table 1) the economic analysis revealed that maize crop grown with intercropped soybean under *Faidherbia albida* trees fetched a maximum monetary returns as compared to other cropping systems (Temesgen desalegn, 2002). The increase in gross and monetary returns from maize+soybean cropping system in *Faidherbia albida* trees was by 9.5 per cent and 11.8 per cent over maize alone, by 0.7 per cent and 13.8 per cent over fieldbean, by 12.9 per cent and 27.6 per cent over cowpea and, 28.7 per cent and 51.6 per cent over groundnut, respectively. Similar trend was followed in the case of benefic cost ratio (B:C) were maize+soybean cropping system in *Faidherbia albida* trees showed the highest B:C ratio (1.54) and the least with maize + groundnut (0.70) in *Faidherbia*

albida trees. The higher monetary returns obtained in maize + soybean under *Faidherbia albida* trees could be attributed to improved performance of soybean when grown as intercrop in maize in association with *Faidherbia albida* trees indicating its compatibility in tree crop integration system. The yield of the crops and returns from the crops were improved to the maximum extent when grown in association with trees because of significant contribution by *Faidherbia albida* which is mainly deciduous in nature during rainy season facilitating abundant light availability to the underneath crops and also site improvement due to addition of litter.

The monetary returns from the system (tree+crop) also showed the similar trend with the cropping systems (Table2). The increased monetary returns under maize based cropping systems in association with trees were mainly due to additional income obtained from the value added products of the tree like small timber wood, fuel etc.,

It was clearly evident from the results that the nitrogen fixing trees like *Faidherbia albida* would benefit the dryland farmer in improvement of economic status when grown along with the crop in different ways like site enrichment, crop productivity improvement and additional income from the trees (Kanchana, 1998 and Bhemaiah *et al.*, 1992).

Hardwickia binata based alleycropping system :

The economic evaluation of crop management practices studied in *Hardwickia binata* based alleycropping system (Table 3) showed that gross and net monetary returns from the crop were substantially higher under sole cropping of sunflower without trees as well as intercropping of sunflower in pollarded trees while sunflower crop when intercropped with unpollarded

Table 1 : Yields, gross and net monetary returns and B:C ratio of the crop in *Faidherbia albida* based agrisilviculture system

Cropping system	Maize equivalent yield (q/ha)	Gross monetary returns (Rs./ha)	Net monetary returns (Rs./ha)	B : C ratio
1. Maize alone with trees	26.60	13299.44	7863.44	1.45
2. Maize + cowpea with trees	25.57	12786.67	6453.67	1.02
3. Maize + field bean with trees	29.17	14584.44	7688.44	1.11
4. Maize + soybean with trees	20.38	14691.67	8915.67	1.54
5. Maize + groundnut with trees	20.95	10474.44	4310.44	0.70
6. Sole maize without trees	16.68	9339.00	3764.00	0.66

Table 2 : Total gross and monetary returns (Rs./ha) of the system in *Faidherbia albida* based agrisilviculture system

Cropping system	Total gross monetary returns (Rs./ha)	Total net monetary returns (Rs./ha)	B : C ratio
1. Maize alone with trees	15737.11	10301.11	1.89
2. Maize + cowpea with trees	15224.33	8891.33	1.40
3. Maize + field bean with trees	17022.11	10126.1	1.45
4. Maize + soybean with trees	17129.34	11275.56	1.86
5. Maize + groundnut with trees	12912.11	6714.78	1.10
6. Sole maize without trees	9339.00	3764.00	0.66

Cropping system	Seed yield (kg/ha)	Gross return (Rs./ha)	Net returns (Rs./ha)	B : C ratio
1. Intercropping (IC) in unpollarded trees	306.33	3676	-1391	-0.28
2. IC in unpollarded trees with trench	298.33	3580	-1487	-0.29
3. IC in pollarded trees	687.67	8352	3285	0.64
4. IC in pollarded trees with trench	687.33	8248	3181	0.63
5. Sole cropping of sunflower	716.67	8500	3433	0.67

trees recorded negative values in monetary returns. The increase in gross and net monetary returns from the crops in sole cropping of sunflower as well as intercropping of sunflower in pollarded trees was by 56 to 58 per cent and 142 to 147 per cent over intercropping of sunflower in unpollarded trees. Similarly B:C ratio also showed the same trend of influence due to crop management practices. The improved monetary returns from the sunflower crop when grown as intercrop in pollarded trees of *Hardwickia binata* could be attributed to the least competition for resources coupled with better performance of crop growth and higher seed yields.

Whereas, while considering the total monetary returns from the system (tree+crop), sunflower grown as intercrop in pollarded trees gave the highest monetary returns over that intercropped sunflower in unpollarded trees but the returns were found minimum when sunflower grown as sole crop without trees (Table 4). The improved monetary returns obtained from the sunflower crop when grown in pollarded trees was mainly due to the additional advantage of value added products from *Hardwickia binata* in the form of pole, fuel wood, fodder etc. coupled with good performance of sunflower crop without any competition for natural resources

in this tree crop association.

Economic gain system from medium dry land farmers:

Through arable farming is the dominant form of agriculture in Andhra Pradesh, the alternate land use system like agrihorticultural system is received attention especially in drylands because this system provides stability and sustainability to farming system for medium level farmers in semi arid tropics. The integration of fruit trees with arable crops is intended to maximize the land and space use efficiency to generate supplemental income, through efficient utilization of resources to the farmers of drylands.

Economic evaluation of different cropping systems revealed that soybean when grown as sole crop fetched maximum monetary returns when compared to intercropping of soybean either in guava or in curry leaf (Table 5). The reduction in returns from soybean crop when grown in association with horticultural trees was mainly due to competition by trees on natural resources.

Whereas, the monetary returns from the system *i.e.* combined returns from the tree and crop were increased to the maximum extent under intercropping of soybean either in guava

Cropping system	Total gross returns (Rs./ha)	Total net returns (Rs./ha)	B : C ratio
1. Intercropping (IC) in unpollarded trees	8364	3231	0.64
2. IC in unpollarded trees with trench	8268	2451	0.42
3. IC in pollarded trees	13040	7523	1.36
4. IC in pollarded trees with trench	12936	6669	1.06
5. Sole cropping of sunflower	8500	3433	0.67

Cropping system	Seed yield (kg/ha)	Gross return (Rs./ha)	Net returns (Rs./ha)	B : C ratio
1. Intercropping of soybean in guava	738.95	8867	2539	0.40
2. Intercropping of soybean in curry leaf	740.11	8881	2553	0.40
3. Sole cropping of soybean	799.79	9597	3269	0.51

Cropping system	Total gross returns (Rs./ha)	Total net returns (Rs./ha)	B : C ratio
1. Intercropping of soybean in guava	15100	8021	1.13
2. Intercropping of soybean in curry leaf	11923	4845	0.68
3. Solecropping of soybean	9597	3269	0.51

or curry leaf plantations mainly due to additional income from the sale of fruits of guava and curry leaf (Table 6). Similar trend in B.C ratio was observed. The returns obtained from mature products from the trees during cropping period were included in computing the monetary returns from the system. The subsequent fruit/leaf harvest from the trees will further enhance the monetary returns in these tree based agrihorticultural systems.

Agroforestry, by virtue of incorporation of perennials and herbaceous plants in the same land management unit, can provide multitude of products and services, can help the resource poor farmers to improve productivity and meet the future demand for fuel, fodder, timber etc.

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