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Performance of Rainfed Groundnut under Integrated Nutrient Management Practices in Hardwickia (*Hardwickia Binata*) Plantation

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Abstract: *A field study was conducted during* kharif *seasons of 2005 and 2006 at Students' Farm on red sandy loam soil to study the performance of ground nut in hardwickia plantation under different integrated nutrient management practices. The results showed that the pod yield of groundnut was significantly higher in solecropping than the intercropping of groundnut in unpollarded hardwickia. But the groundnut pod yields under pollarded hardwickia were atpar to that of solecropped groundnut. Maximum pod yield was obtained by application of recommended dose of NPK + vermicompost and enriched FYM with recommended dose of NPK during both the years. Similar response was observed in LAI and dry matter production. However, intercropping of groundnut in pollarded hardwickia trees proved effective in enhancement of growth and yield attributing characters resulting in substantial increase in pod and haulm yields when compared to those intercropping of groundnut in unpollarded hardwickia trees. Soil physical and chemical properties like bulk density and nutrient status were improved before and after cropping in hardwickia plantation when compared to solecropping.*

Keywords: *Hardwickia, Groundnut, Intercropping, Solecropping.*

INTRODUCTION

The small and marginal farmers who are dependent on rainfed solecrop farming rarely get remunerative returns from monocropping. Hence, they are shifting towards other production systems like tree based cropping system which provide stability in production particularly in adverse climatic conditions when agricultural crops fail. In SAT regions, for imparting stability and sustainability, inclusion of certain nitrogen fixing tree species (NFT) like *Hardwickia binata, Dalbergia sissoo, Leucaena leucocephala etc.,* in an agroforestry system offers immense possibility of supplementing a part of nitrogen requirement of the associated crops, besides enriching the site through addition of organic matter and helps to cater the basic needs of poor farmers in drylands. To regularize the shade in an agroforestry system, trees are cut back or kept pruned throughout the crop growth period to avoid competition on natural resources like light, moisture and nutrients. Escalating cost of inorganic fertilizers, their undesirable impact on the physical condition of soil, erratic rainfall and poverty call for immediate inclusion of organic sources in any rainfed cropping system. Soil fertility buildup through agroforestry and practice of integrated nutrient management were suggested as potential means to increase the soil fertility especially in drylands. Application of commercial fertilizers in large quantities is not only expensive and often results in imbalance of soil reserves. Adoption integrated nutrient management practices in integrated NFT's with oil seed crops is highly imperative to achieve self-sufficiency in oil seed production even in drylands also.

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MATERIAL AND METHODS

A field experiment was conducted during *kharif* seasons of 2005 and 2006 at Students' Farm, College of Agriculture, Rajendranagar, Hyderabad. The experimental site was under ten years old hardwickia plantation spaced at 4m × 4m. The soil in hardwickia plantation was red sandy loam, medium in organic carbon (0.66 and 0.67%), available N (314.5 and 319 kg ha^{-1}), available P (37.4 and 38.2 kg ha^{-1}) and available K (236 and 237 kg ha^{-1}) respectively during 2005 and 2006, whereas the open area was low in organic carbon (0.28 and 0.30%) and available N (189.8 and 190.3 kg ha^{-1}), medium in available P (26.4 and 26.8 kg ha^{-1}) and available K (216.5 and 217.4 kg ha^{-1}) respectively during 2005 and 2006. The treatments comprised of 3 cropping situations *viz.*, intercropping of groundnut in pollarded hardwickia, intercropping of groundnut in unpollarded hardwickia and solecropping of groundnut as main plots and seven integrated nutrient management practices as sub plots *viz.*, recommended dose of NPK (20:40:40), recommended dose of NPK + FYM (10 t ha^{-1}), recommended dose of NPK + vermicompost (2 t ha^{-1}), enriched FYM (750 kg ha^{-1}) with recommended dose of NPK, 50% recommended dose of NPK + FYM (10 t ha^{-1}), 50% RDF + vermicompost (2 t ha^{-1}) and enriched FYM (750 kg ha^{-1}) with 50% RDF.

The experiment was laid out in split plot design with three replications. The plot sizes were 4 m × 4 m in intercropping and solecropping as well. Hardwickia trees were cut above 3 m height under the treatment of inter-cropping of groundnut in pollarded hardwickia during both the years of study. The groundnut variety TMV - 2 was selected as intercrop and sown at recommended spacing both in intercropping and solecropping situations on 15th July 2005 and 4th July 2006. Groundnut was grown as rainfed crop in the system. The total rainfall was received in the cropping season was 800 mm rainfall distributed in 41 rainy days during 2005 and 498 mm rainfall distributed in 35 rainy days 2006.

RESULTS AND DISCUSSION

Growth, Yield and Yield Attributes

It was clearly evident from the data recorded on Dry matter production, LAI, yield and yield attributing characters *viz.*, 100-pod weight and shelling percentage that groundnut crop when grown as solecrop produced higher values of yield attributes than those of intercropped groundnut. However, intercropping of groundnut in pollarded hardwickia trees also increased these attributing characters markedly when compared to intercropping of groundnut in unpollarded hardwickia trees.

The better yield attributes obtained in groundnut when grown as an intercrop in pollarded trees might be due to uninterrupted light transmission available to the intercrop resulting ultimately in better plant growth and yield attributes, because of removal of tree canopies in the system. It was clearly noticed from the yield data that the pod and haulm yields were increased to the maximum extent when groundnut was grown as solecrop in comparison with intercropping of ground nut in pollarded hardwickia and unpollarded hardwickia trees by 20.7% and 140.9%, respectively during 2005 and by 28.0% and 127.8% respectively during 2006.

This clearly indicated that there was drastic decrease in both pod and haulm yields under intercropping situation when ground nut grown in unpollarded trees. Similar trend was observed in Dry matter production, LAI, harvest index also. The increased yields in pollarded hardwickia could be attributed to resultant effects of favourable plant growth and better yield attributes because there was no competition absolutely on natural resources available (1).

The Dry matter production, LAI, yield and yield attributing characters of groundnut like 100-pod weight and shelling percentage were found improved to the maximum extent with the application of recommended dose of N, P and K either with the combination of vermicompost or enriched FYM among the integrated nutrient management practices studied. However, application of NPK alone or with the combination of FYM also proved effective in enhancement of these yield attributing characters when compared to application of 50% recommended dose of NPK with combination of different organic manures. The positive response with higher doses of NPK in

Table 1
Effect of cropping situations and integrated nutrient management practices on growth of groundnut in hardwickia based agrisilvicultural system

Treatments	*Leaf Area Index*		*Drymatter production per plant (g)*	
	2005	*2006*	*2005*	*2006*
Cropping situations (CS)				
Intercropping of groundnut to pollarded hardwickia	4.0	4.4	14.8	14.2
Intercropping of groundnut to unpollarded hardwickia	3.6	3.9	12.2	11.4
Sole cropping	4.6	5.0	15.2	14.4
SEm+	0.11	0.13	0.24	0.14
CD (P = 0.05)	0.31	0.36	0.92	0.56
Integrated nutrient management practices (INM)				
Recommended dose of NPK (20: 40 : 40 kg ha^{-1})	4.1	4.5	13.9	13.2
Recommended dose of NPK + FYM (10 t ha^{-1})	4.4	4.8	14.5	13.6
Recommended dose of NPK + Vermicompost (2 t ha^{-1})	4.6	5.0	15.8	14.8
Enrichment of FYM (750 kg ha^{-1}) with Recommended dose of NPK	4.7	5.1	15.7	15.0
50 % Recommended dose of NPK + FYM (10 t ha^{-1})	3.3	3.7	12.2	11.7
50 % Recommended dose of NPK + Vermicompost (2 t ha^{-1})	3.6	3.8	13.1	12.5
Enrichment of FYM (750 kg ha^{-1}) with 50 % Recommended dose of NPK	3.6	3.9	13.2	12.7
SEm+	0.11	0.08	0.20	0.18
CD (*P* = 0.05)	0.23	0.16	0.57	0.51

improvement of yield attributes of groundnut might be mainly due to adequate supply of nutrients to the crop grown under marginal soils of dry lands. Further, application of vermicompost as well as enrichment of FYM also might have helped in improvement of yield attributing characters of groundnut because of better improvement in soil properties as well as moisture availability for better crop growth. Similar findings were obtained by (2, 3, 4).

Profit Per Rupee Investment

Profit per rupee investment was also found to be maximum under intercropping of groundnut in pollarded hardwickia followed by solecropping of groundnut (Table 3). Whereas, profit per rupee investment was found to be very low under intercropping of groundnut in unpollarded trees. Profit per rupee investment also increased with the application of organic manures except vermicompost at recommended dose of NPK under intercropping of groundnut in pollarded hardwickia trees. However, the profit per rupee investment was found better with enrichment of FYM with recommended dose of NPK under solecropping of groundnut also. But 50% recommended dose of NPK with vermicompost reduced the profit per rupee investment to the lowest under intercropping of groundnut in unpollarded hardwickia trees. Similar results were reported in tree crop combination studies (3, 4).

The data on physical and chemical properties of soil before and after cropping revealed that in general soil properties with respect to physical and chemical were improved in hardwickia plantation when compared to treeless area under solecropping. Bulk density was decreased considerably in plantation area before cropping and after cropping when compared to that of treeless area. This was attributed due to the increase in porosity because of addition of leaf litter over the years. The reduction in soil pH and EC was observed under inter-cropping situation in hardwickia trees when

Table 2
Effect of cropping situations and integrated nutrient management practices on yield attributes and yield of groundnut in hardwickia based agrisilvicultural system

	100-pod weight (g)		*Shelling percent (%)*		*Pod yield (kg ha^{-1})*		*Haulm yield (kg ha^{-1})*	
Treatments	*2005*	*2006*	*2005*	*2006*	*2005*	*2006*	*2005*	*2006*
Cropping situations (CS)								
Intercropping of groundnut to pollarded hardwickia	45.9	45.4	61.9	60.5	785.3	683.6	3204	3323
Intercropping of groundnut to unpollarded hardwickia	41.8	41.5	54.5	55.3	393.6	384.2	2833	2990
Sole cropping	46.6	45.9	62.9	61.5	948.2	875.1	3153	3336
SEm+	1.11	0.98	0.86	0.75	32.73	23.29	17.1	4806
CD (P = 0.05)	3.08	2.73	2.39	2.10	90.87	64.64	47.6	134.9
Integrated nutrient management practices (INM)								
Recommended dose of NPK (20 : 40 : 40 kg ha^{-1})	44.9	44.1	62.1	60.6	701.5	644.1	3070	3214
Recommended dose of NPK + FYM (10 t ha^{-1})	46.3	45.4	64.2	62.4	814.3	728.8	3247	3382
Recommended dose ofNPK+Vermicompost(2t ha^{-1})	48.1	47.4	67.6	66.7	896.2	838.2	3556	3702
Enrichment of FYM (750 kg ha^{-1}) with Recommended dose of NPK	48.0	47.5	67.9	66.6	877.8	843.6	3591	3742
50 % Recommended dose of NPK + FYM (10t ha^{-1})	41.3	40.8	52.4	51.1	521.5	456.3	2570	2713
50 % Recommended dose of NPK+Vermicompost(2 t ha^{-1})	42.4	42.1	54.1	52.8	577.7	509.8	2705	2872
Enrichment of FYM (750 kg ha^{-1}) with 50 % Recommended dose of NPK	12.3	42.2	54.7	53.5	574.2	512.6	2704	2887
SEm+	0.31	0.32	0.49	0.56	19.51	23.87	51.9	28.5
CD (P = 0.05)	0.61	0.66	1.00	1.14	39.58	48.43	105.2	57.9

Table 3
Profit per rupee investment from the system (tree + crop) as influenced by cropping situations and integrated nutrient management practices in agrisilvicultural system

Treatments	*Intercropping in pollarded hardwickia*		*Intercropping in unpollarded hardwickia*		*Solecropping*	
	2005	*2006*	*2005*	*2006*	*2005*	*2006*
Recommended dose of NPK (20:40:40 kg ha^{-1})	2.23	1.97	1.26	1.31	1.89	1.82
Recommended dose of NPK + FYM (10 t ha^{-1})	2.06	1.71	1.06	1.10	1.75	1.60
Recommended dose of NPK + Vermicompost (2 t ha^{-1})	1.49	1.35	0.64	0.63	1.20	1.12
Enriched FYM (750 kg ha^{-1}) with Recommended dose of NPK	2.68	2.53	1.39	1.54	2.32	2.30
50 % Recommended dose of NPK + FYM (10 t ha^{-1})	1.30	1.13	0.65	0.69	1.23	0.96
50 % Recommended dose of NPK + Vermicompost (2 t ha^{-1})	0.83	0.70	0.27	0.24	0.73	0.56
Enriched FYM (750 kg ha^{-1}) with 50 % Recommended dose of NPK	1.92	1.64	1.04	1.01	1.71	1.51
Mean	1.76	1.57	0.89	0.93	1.55	1.41

compared to solecropping situation (open area). This might be due to production of organic acids during biological decomposition of leaf litter. Whereas, organic carbon content in the soil was found increased in tree planted area when compared to open area. There was not much variation in organic carbon content of soil before and after cropping. Similarly there was considerable improvement in available N, P and K in soils, where hardwickia plantation was there when compared to open area. These chemical properties of soil were found improved after cropping when compared to before cropping because of beneficial effects of trees possessing the deep and extension root system and leaf fall resulting in site improvement (5).

Hardwickia based agrisilvicultural system also proved effective in rainfed agriculture in obtaining higher monetary returns from tree crop association when the trees were pollarded when compared to the returns obtained from the solecropped groundnut. This was mainly due to value added tree products like pole, fuel, wood and fodder *etc.* and also improve physical and chemical properties of soil by adding the heavy leaf litter into soil over the years (5, 6, 7).

References

Indudhar Reddy K, Hemalatha S, Jayasree G and Praveen Rao V (2013), A critical review on integrated nutrient management in pongamia + castor agri-silvi system. International Journal of Plant, Animal and Environmental Sciences 3 : 136-142.

Chaithanya Devi M, Ramavatharam N, Naidu M V S and Reddy K S (2003), Effect of inorganic fertilizers and organic manures on growth, yield and uptake of nutrients by groundnut, *Arachis hypogea*. Journal of Oilseeds Research 20(1): 126-128.

Devaranavadgi S B, Hunghal C S, Podalar R S, Wali S Y and Patil M B (2005), Economics of chickpea based agri-silvicultural systems in northern dry agroclimatic zone of Karnataka, India. Indian Journal of Dryland Agriculture Research and Development 20(2): 137-140.

Korwar G R (1986), Studies on alley cropping and agri-silviculture systems in black soils under dryland agriculture conditions. Ph.D Thesis submitted to University of Agricultural Sciences, Dharwad.

Jaisankar I, Revathi R, Backiyavathy M R, Parthiban K T and Jude Sudhagar R (2014), Response of dalbergia sissoo roxb. to integrated nutrient management practices in agri-silviculture system. Karnataka Journal of Agricultural Sciences 27(2): 193-198.

Hazra C R (1995), Effect of tree species on fodder and seed yields of berseem, soil properties and residual effect of dinanath grass. Range Management and Agroforestry 16(1): 73-78.

Roy M M (1999), Litter fall and nutrient store in a silvipastoral system based on *Hardwickia binata* Roxb. in semi-arid India. Annals of Forestry 7(1): 70-76.