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Effect of Integrated Nutrient Management on Growth and Economic Yield of *Zea mays* under Agri-Silvi System

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ABSTRACT

A field experiment was conducted during 2017-2019 to study the effect of integrated nutrient management on maize crop growth and yield below the *Melia dubia* tree canopy. At 90 DAS, the plant height was significantly higher (186.71 cm) in sole maize without any *Melia dubia* trees, this was followed by 125% RDF in agro-forestry system. Among the nutrient management practices sole maize recorded highest grain yield (4,819 kg) which was at par with 125% RDF in agro-forestry system (4,615 kg). This was followed by 100% RDF in agro-forestry system which was at par with 75% RDF (NPK kg ha^{-1}) + 25% N through FYM; 125% RDF in agro-forestry system recorded significantly higher net returns (Rs 70,472 ha^{-1}) and B:C ratio (2.65). Lowest net returns and B:C ratio was recorded in 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM. Shade percentage has increased from 29%, 2017 (East West direction) to 45% during 2018.

Keywords *Melia dubia,* Shade effect, Integrated nutrient management, Agro-forestry, Yield reduction.

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INTRODUCTION

In developing countries like India, the land resources are shrinking due to increase in population and it is very difficult to bring arable lands under forest cover. Therefore, an integrated approach of land management to utilize the natural resources more efficiently is to essential to meet the requirements of farmer and his livestock without deteriorating the land productivity (TDET Annual report 2017-18). Agro-forestry systems with judicious mixing of crops, trees and grasses meet the requirements of mankind and his livestock (Singh 2002). This system also play a promising role for environmental considerations. It is an established fact that there is reduction in crop yield when crops were grown with tree plantations (Mandal et al. 2010) particularly at later stage of tree growth. If tree and crop components represent approximately equal direct value relative to the area occupied by farmers, a week complimentarity has to be pronounced (Anonymous 2017). Considering the above in view experiment was conducted in one year old plantation of *Melia dubia* to identify fertilizer requirement and optimum economic yields of inter crops may be obtained while retaining the plantations.

MATERIALS AND METHODS

A field experiment was conducted at Regional Sugarcane and Rice Research Station, Rudrur, situated at an altitude of 286.3. m above mean sea level (MSL)

at 18^0 49'41'' N latitude and 78° 56'45'' E longitude. The experimental site is in Northern Telangana agro climatic zone of Telangana State, India and experiences semiarid climate. One year old *Melia dubia* trees were selected to study the effect of integrated nutrient management effect on *Zea mays* growth and yield. The soil was sandy loam with pH of 8.1 and organic carbon 0.18% with EC of 0.19 d Sm^{-1}. The fertility status of the soil was low, medium and high in available nitrogen, phosphorus and potassium respectively. According to Trolls classification, the site falls under semi arid tropics (SAT). Total rainfall of 532 mm was received in 30 rainy days during the crop growth period. The weekly mean minimum and maximum temperatures during the crop period i.e. June to October ranged from 21.3 to 27.4 ^{0}C and 31.2 and 36.3 ^{0}C respectively. The weekly mean relative humidity ranged from 50.9 to 83.15 while average relative humidity was 72.5%. The experiment was laid out in Randomized Block Design with five nutrient management treatments viz., T_1 – sole crop maize i.e. without trees, T_2 – 125% RDF (NPK kg ha^{-1}) in agro-forestry system, T_3 – 100% RDF (NPK kg ha^{-1}) in agro-forestry system, T_4 – 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM and T_5 – 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure and replicated thrice. The recommended dose of fertilizer (RDF) adopted for 100% RDF was 200:60:60 kg N, P_2O_5, K_2O kg ha^{-1} in the form of urea, di-ammoniun phosphate and muriate of potash, respectively. All the recommended package of practices were followed for raising the crop. Data involving plan height, cob length, grain yield and benefit cost ratio were collected.

RESULTS AND DISCUSSION

Plant height (cm)

Data on the plant height recorded at 30, 60 and 90 DAS as influenced by different nutrient nanagement treatments are presented in (Table 1). The difference in plant height among the treatments were statistically significant at all the growth stages of the crop.

The crop growth was slow in the initial stages but there was a rapid increase in plant height from 30 to 60 DAS and there after the increase in plant height was marginal until harvest.

At 30 DAS, sole maize recorded significantly taller (42.73) plant and at par with 125% RDF and 100% RDF in agro-forestry system. At 60 DAS sole maize recorded significantly taller (96.70) plant and this was followed by 125% RDF and was at par with 100% RDF in agro-forestry system. At 90 DAS, the plant height was significantly higher (186.71 cm) in sole maize. This was followed by 125% RDF in agro-forestry systen; 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM which was at par with 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure.

Fresh weight (kg ha^{-1})

The data on fresh weight at 30 and 60 DAS presented in Table 1 indicated that nutrient management practices significantly influenced the fresh weight.

At initial stages of crop growth fresh weight

Table 1. Effect of nutrient management of rainfed maize on plant height, fresh weight, cob length and test weight.

Treatments	Plant height (cm)			Fresh weight (kg ha^{-1})		Cob length (cm)	Test weight (g/100)
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS		
T_1	42.73	96.70	186.71	2605	10747	16.40	31.90
T_2	39.54	81.08	180.22	2264	8839	13.97	29.93
T_3	39.01	80.23	161.90	2147	8339	13.93	25.15
T_4	33.82	67.35	156.52	1934	8083	12.82	24.43
T_5	33.42	65.78	150.58	1897	8347	11.93	23.60
SEm (±)	1.85	4.23	6.91	128.5	592.4	0.65	1.28
CD (p=0.05)	5.71	13.02	18.26	396.0	1825.4	2.00	3.94

Table 2. Effect of nutrient management on grain, straw yield and economics of rainfed maize.

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net returns (Rs ha^{-1})	B:ratio
T_1	4819.45	6534.29	74925	2.91
T_2	4615.28	6014.62	70472	2.65
T_3	3567.10	4062.75	43589	2.11
T_4	3392.11	4067.00	33602	1.74
T_5	3546.06	4285.50	33719	1.77
SEm (±)	317.90	332.99	-	-
CD (p=0.05)	979.54	1026	-	-

Table 3. Soil available nutrients after harvest of maize.

Treatments	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})
T_1	180	53.25	371
T_2	186	54.25	379
T_3	176	51.06	375
T_4	185	54.98	388
T_5	189	54.65	381
SEm (±)	8.04	1.37	4.59
CD (p=0.05)	NS	NS	NS

was low. However, 30 DAS, sole maize recorded significantly higher (2,605 kg ha^{-1}) fresh weight which was at par with 125% RDF in agro-forestry system. Lowest fresh weight was recorded in 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM which was at par with 75% RDF(NPK kg ha^{-1}) in Agro-Forestry system + 25% N throughpoultry manure and 100% RDF in agro-forestry system (Upadhyaya et al. 2003). At 60 DAS, sole maize showed significantly higher (10, 747 kg ha^{-1}) fresh weight compared to other treatment and which was followed by 125% RDF in agro-forestry system which was at par with 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM which was at par with 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure and 100% RDF in agro-forestry system.

Yield atributes

Yield attributes are the most vital parameters which need an improvement through its combined influence on total economic production of the crop. The data on cob length, cob girth, number of rows per cob grain no, per cob test weight are presented in the Table 2.

Cob length (cm)

Sole maize recorded higher length of cob (16.40) which was followed by 125% RDF in agro-forestry system and was at par with 100% RDF in agro-forestry system 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM.

Test weight (g/100 grain)

Among nutrient management practices sole maize recorded significantly higher test weight (31.90) compared to other nutrient management practices and which was at par with 125% RDF in agro-forestry system. Lowest test weight was recorded in 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure.

Grain yield (kg ha^{-1})

Among the nutrient management practices sole maize recorded highest grain yield (4819) which was at par with 125% RDF in agro-forestry system (4615). This was followed by 100% RDF in agro-forestry system which was at par with 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM and 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure (Chaturvedi et al. 2010) (Table 2).

Straw yield (kg ha^{-1})

Among the nutrient management practices sole maize recorded highest straw yield (6534) which was at par with 125% RDF in agro-forestry system (6014). This was followed by 100% RDF in agro-forestry system which was at par with 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM and 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through poultry manure.

Economics

Data concerning economic parameters are presented in Table 3. Sole maize recorded highest net returns

(Rs 74,925 ha^{-1}) and highest B:C ratio (2.91) (Mandal et al. 2010). However among the agro-forestry systems 125% RDF in agro-forestry system recorded significantly higher net returns (Rs 70, 472 ha^{-1}) and B:C ratio (2.65). Lowest net returns and B:C ratio was recorded in 75% RDF (NPK kg ha^{-1}) in Agro-Forestry system + 25% N through FYM (Mathumika et al. 2013).

Available N, P_2O_5 and K_2O in soil after harvest of crop

There was no significant difference in available N, P_2O_5 and K_2O due to different nutrient management treatments, however higher available N, P_2O_5 and K_2O was recorded in 125% RDF in agro-forestry system.

Sole maize without agro-forestry system recorded highest grain yield (4,819 kg ha^{-1}) which was at par with within the agro-forestry system 125% RDF in agro-forestry system recorded higher yield (4615) and net returns (Rs 70,472 ha^{-1})

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REFERENCES

Anonymous (2017) Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India. www. Indiastat.com

Chaturvedi OP, Das DK, Kumar R (2010) A comparative study of the rooting depth of four agro-forestry tree species interplanted on boundary of wheat crop field in Bihar plains. Int J Ecol and Environ Sci 31 (1) : 49—52.

Mandal MP, Das DK, Chaturvedi OP (2010) Allelopathic effect of agro-forestry tree species on seed germination and seedling growth of paddy varieties. Range Manag and Agro-for 2 : 2—4.

Mathumika RK, Dobariya BS, Gohil BS (2013) Integrated weed management in *rabi* sweet corn *(Zea mays* var *saccharata)*. Adv in Crop Sci and Tech 2 : 2—6.

Singh P (2002) Realizing an agricultural dream. In : Ravi N (ed). Hindu Survey of Ind Agric. The Hindu, Chennai, pp 15—21.

TDET Annual Report (2017-18) Report submitted to Ministry of Rural Development, DOLR, GOI, New Delhi, pp 26.

Upadhyaya SD, Nema, Sharad (2003) Nitrogen supplement in paddy field through *Acacia nilotica* planted at farm bund-A sustainable tree based cropping system. Ind J Pl Physiol (Special issue) 13 (5) : 72—75.