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The effect of fertilization on growth & yield of rain fed Blackgram in custard apple based Agri-horti-system with Alley Cropping Pattern on Vindhyan soil.

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Abstract- One- year field experiments were conducted to evaluate the effect of fertilization on growth & yield of rainfed blackgram in custard apple based agri-horti-system with alley cropping pattern on Vindhyan soil. The factors under study comprised of Control plot (T_1), 2% urea spray (twice fifteen days intervals)(T_2), 100% RDF (T_3), 50%RDF + 25kg Zinc sulphate(T_4), 50% RDF + 2% urea spray + 25 kg zinc sulphate (T_5), 100%RDF + 25kg Zinc sulphate(T_6) and 2% urea spray + 25kg Zinc sulphate(T_7) were laid out in randomized block design. The treatments were replicated three times. However, a significant increase in grain yield was observed under 100% RDF + 25kg Zinc sulphate (T_6). It was recorded maximum net return Rs.18143/ha in case of 100% RDF + 25 kg zinc sulphate under the alley cropping.

Index Terms- Alley cropping pattern, Agri-horti-system, Fertilization, Black gram, Growth, yield and net return.

I. INTRODUCTION

Agroforestry integrates trees into farmland and rangeland and in so doing diversifies and sustains production for increased benefits for farmers and the environment. Agroforestry systems complement conservation agriculture systems in the provision of soil cover, animal feed, nutrients, household fuel, and hillside protection against soil erosion and wind erosion control through shelter belts (Sims *et al.,* 2009).

Alley cropping research has indicated few detailed studies of the effects of competition for moisture and nutrients. This may be partly reduced by assumption that trees place their roots deeper in the soil profile than most crops and that competition is therefore avoided.

Khalifa and Ong (1990) and Lin (2007) were of the opinion that shading may be beneficial when crops frequently experience supra-optimal temperatures, as is well documented for agroforestry systems (Jonsson *et al.,* 1999), (Ong *et al.,* 2006) and Ong *et al.* (1999) concluded from their study that competition between neighbouring roots occurred when the nutrient depletion zones around the roots overlap, which was caused by the uptake of nutrients into the roots. Ovalle and Avendano (1987) reported that crop yield losses in alley cropping systems were affected directly from competition for soil water.

The custard apple (*Annona squamosa*) is commonly cultivated in tropical South America, not often in Central America, very frequently in Southern Mexico, the West Indies, Bahamas and Bermuda, and occasionally in southern Florida. Black gram originated in India and cultivated on marginal land by resource-poor farmers. In the past seven years, it has been observed that the total 15.5 lakh tones in India. Andhra Pradesh is the largest producer of black gram in India. Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Orissa are other major producing states. Black gram (*Vigna mungo*) was grown in a black gram/ mustard (*Brassica juncea*) crop sequence and was given 0, 15 or 30 kg N/ha, 0, 30 or 60 kg P_2O_5/ha and 0 or 60 kg S/ha with a uniform application of 25 kg K_2O/ha to all treatments.

II. METHOD

Field experiments were conducted over one years (2009-10) under rainfed and invariably poor fertile status at the experiment was carried out at the Agronomy farm of Rajiv Gandhi South Campus, Brakachha (Banaras Hindu Uuniversity) Mirzapur which is situated in Vindhyan region of district Mirzapur ($25^o10'$ latitude, $82^o37'$ longitude and altitude of 427 meters above mean sea level) occupying over an area of more than 1000 ha where variety of crops like agricultural, horticultural, medicinal & aromatic plants etc are grown. This region comes under agro-climatic zone III A (semi-arid Eastern plain zone). Black gram is the P U-7 and developed at Govind Vallabh Bhai Patel (G.B.) Pantnagar University of Agriculture & Technology, Pantnagar, Uttarakhand, Net plot size was 5.25 m2. The soil at the site was a sandy loam. The factors under study comprised of under control plot (T_1), 2% urea spray (twice fifteen days intervals) (T_2), 100% RDF (T_3), 50% RDF + 25 kg. zinc sulphate (T_4), 50% RDF+2% urea spray+25Kg Zinc sulphate (T_5), 100% RDF + 25 kg Zinc sulphate (T_6) and 2% urea spray + 25 kg Zinc sulphate (T_7) were laid out in randomized block design with three replications. The sowing was done in furrows on the 14 August 2009 in 2009-10 in same fertilized furrows at 35 cm apart opened by spade and covered with soil after seeding at appropriate spacing (10 cm) and depth (5 cm). A seed rate of 15Kg/ha was used for the experiment. In this experiment, Urea, Zinc sulphate and DAP were used as source of nitrogen, zinc and phosphorus respectively. The desired fertilizer doses were placed below the

seed in the respective rows at seeding. The standard analysis of variance for randomized block design to draw a valid conclusion (Cochran and Cox 1963). The treatment differences were tested by Fisher's Method (F test of significant) on the basis of null hypothesis. Critical differences (CD) were worked out at 5 per cent level of probability where 'F' test was significant.

III. RESULTS AND DISCUSSION

1. Growth:

The nutrient combination had significant effect on the plant height, which was measured at different stages of the crop. The plant height of blackgram under different nutrient combinations at harvest stage ranged from 25.67 to 49.70 cm. The maximum plant was recorded in the treatment T_6 (100% RDF + 25 kg. Zinc sulphate) at 20, 40 DAS and at harvest stage of crop which was statistically at par with T_3 and T_5 at 20 DAS, harvest stage and T_3 at 40 DAS and T_4 at harvest stage. The treatment T_6 of proved statistically superior to the remaining treatments. The lowest plant height (12.90, 22.27, 24.17 cm) was observed in control plot at varying stages. As such the plant height increased by 85, 83 and 93 percent at 20, 40 DAS and harvest stage respectively. As regards dry matter production (g) and number of trifoliate leaves, Leaf area index and Grains ear/ head (No.) trend of the results was similar to that noted in plant height.

2. Yield and Yield attributes:

The maximum number of pods in alley cropping system was also recorded in T_6. The pod number ranged from 6.60 to 30.07pods/ plant, the lowest number being T_1. Treatment T_6 proved significantly instrumented in enhancing the pod number in comparison to rest of the treatment. As regards Test weight (g.) trend of the results was similar to that noted in no. of pods/ plants.

The maximum seed yield in alley crop was recorded in 100%+ 25Kg. Zinc sulphate ($T_{6)}$ (8.74 q/ha) which was significantly superior to others. However, the lowest seed yield was recorded with control (3.23 q/ha). As regards straw yield and no. of pods/ plants trend of the results was similar to that noted in Test Weight (g.). Chauhan *et al.* (1995) observed similar that agricultural crop yield was increased with increasing the crop distance from the tree base.

Table 1: Growth and yield influenced by various treatments in alley cropping system of Blackgram

Treatment	Plant dry weight (g.)	Plant height (cm)	Trifoliate leaves/ plant	Test weight (g.)	No. of pods/ plants	Seed yield (q/ha)	Straw yield (q/ha)
	At harvest	At harvest	40 DAS				
T_1	22.67	24.17	4.67	41	6.60	3.23	3.61
T_2	28.67	26.87	5.80	40	12.40	4.91	5.09
T_3	44.00	38.23	8.00	41	16.00	6.24	6.38
T_4	30.64	31.27	7.13	40	19.60	6.32	6.43
T_5	34.77	34.40	7.70	43	20.40	8.37	8.66
T_6	47.70	46.70	7.93	44	30.07	8.74	8.97
T_7	29.73	27.10	6.03	41	10.40	4.67	4.78
Sem±	3.05	2.32	0.66	1.36	2.04	0.39	0.37
CD(%)	6.66	5.05	1.43	2.97	4.45	0.86	0.81

Table 2: Gross return and benefit: cost ratio as influenced by various treatments in alley cropping system of black gram

S.No.	Treatment	Cost of cultivation (Rs./ha)	Sole Crop System		
			Gross return (Rs./ha)	Net return (Rs./ha)	Benefit: Cost ratio
1.	Control	10924	11666	782	0.07
2.	2% urea spray (twice fifteen days intervals	11520	17694	6174	0.53
3.	100% RDF	12583	22478	9895	0.78
4.	50% RDF + 25 kg Zinc Sulphate	12629	22447	9812	0.77
5.	50% RDF + 2% urea spray + 25 kg zinc sulphate	12975	30161	17186	1.32
6.	100% RDF+ 25 kg Zinc sulphate	13344	31487	18143	1.35
7.	2% urea spray + 25 kg zinc sulphate	12520	16823	4303	0.34

Chart 1: Growth and yield influenced by various treatments in alley cropping system of Blackgram

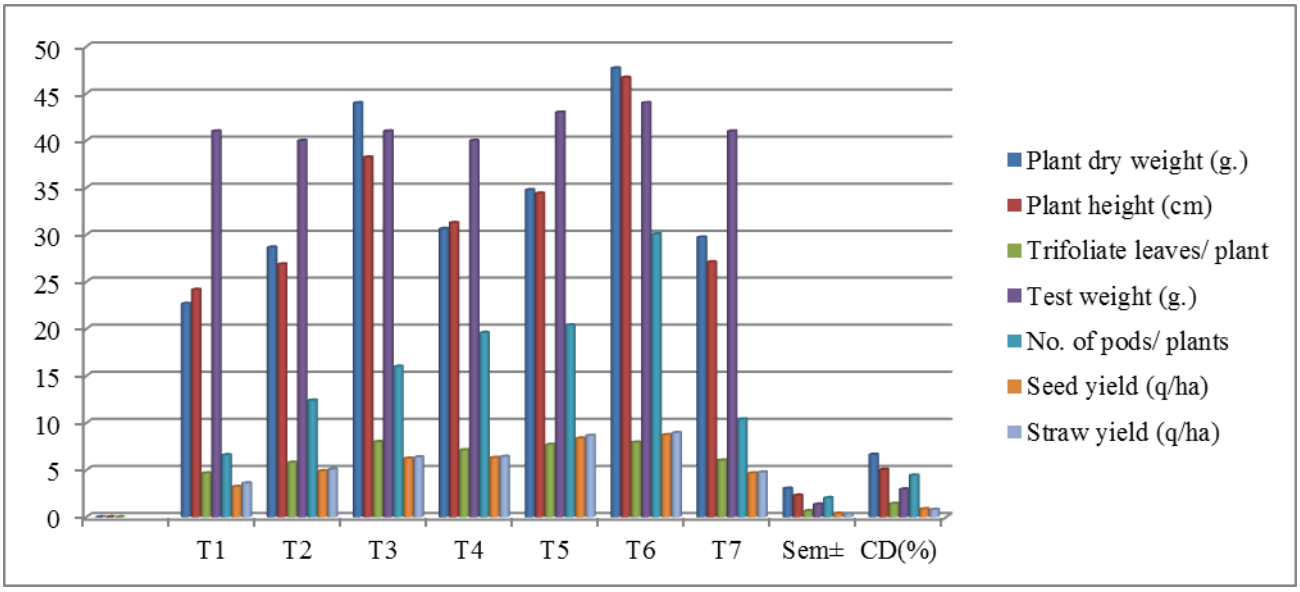
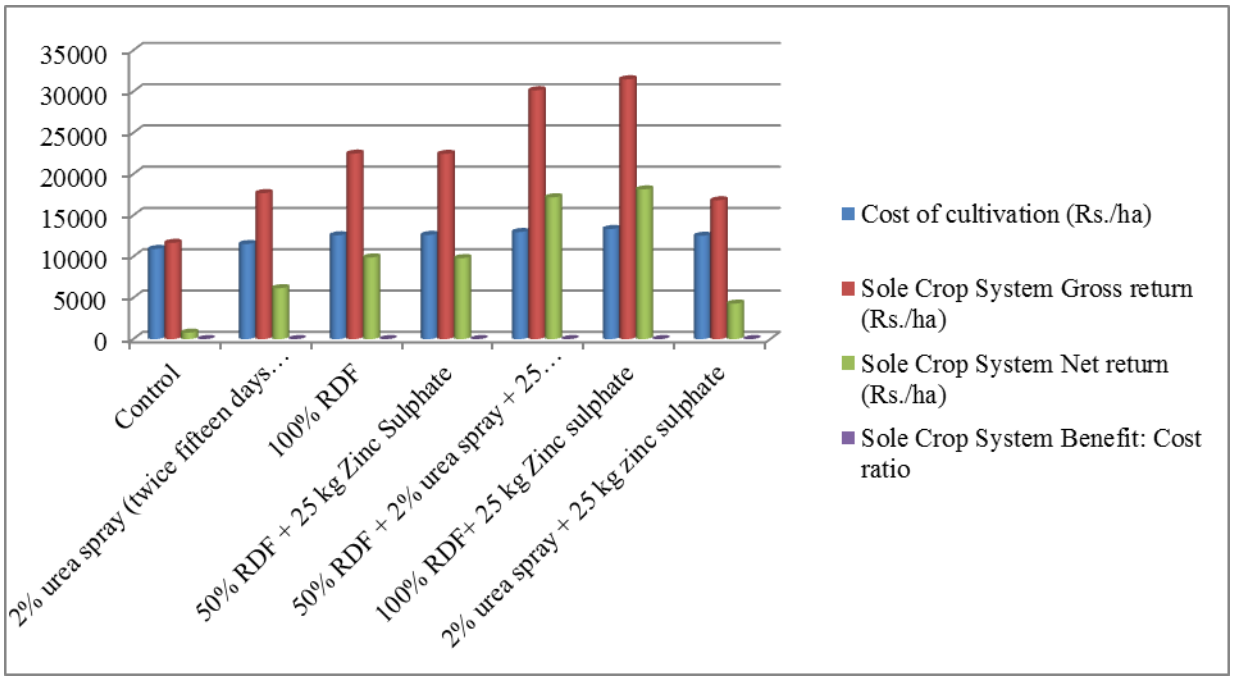


Chart 2: Gross return and benefit: cost ratio as influenced by various treatments in alley cropping system of black gram



IV. ECONOMIC

The total cost of cultivation was maximum (Rs. 13344.00/ha) with 50% RDF + 2% urea spray + 25kg Zinc sulphate while minimum (Rs.10924.00/ha) was noted with control. The different fertilizer combination and nutrient levels recorded maximum gross return (Rs. 31487.00/ha) was recorded with 100% RDF (20N:40P kg/ha) + 25kg Zinc sulphate. The maximum net return of Rs. 18143.00/ha in alley with 100% RDF (20N:40P kg/ha) + 25 kg Zinc sulphate and minimum under Rs. 782.00/ha with control. The maximum benefit cost ratio 1.35 were recorded with 100% RDF (20N:40P Kg/ha) + 25 kg Zinc sulphate under alley cropping, respectively. Bheemaiah and Subrahmanyam (2001) reported that yield and economic of legumes under ber based agri-horticultural system with different levels of fertilizers.

APPENDIX

RDF: Recommended doses of fertilizer
DAS: Days after sowing
DAP: Di-ammonium Phosphate
PU-7: Variety of Black gram released by G.B. Pant Nagar University

CD: Critical Differences

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