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STANDARDIZATION OF BEST MANAGEMENT PRACTICES FOR YIELD MAXIMIZATION IN SUNFLOWER (*Helianthus annuus* L.)

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SUMMARY

A field experiment was conducted to standardize the best management practices for higher yields in sunflower at ZARS, UAS, GKVK, Bengaluru during *kharif* 2011. The results revealed that application of FYM @ 5 t/ha along with 133 percent RDF (120: 120: 80 kg N: P_2O_5: K_2O/ha) at higher plant population level (P_3-74074 plants/ha) recorded higher seed yield (2478 kg/ha) which was statistically at par with 100% RDF with same level of FYM and plant population (2464 kg/ha). Higher oil yield was observed with 100% RDF with FYM @ 5 t/ha & higher plant population (1014 kg/ha) followed by 133% RDF (1011 kg/ha). Hence, adoption of higher plant population level of 74074 plants/ha along with 100 percent RDF and FYM (5 t/ha) is sufficient to generate remunerative income (Rs. 51450/ha) and higher B:C ratio (3.29).

Key words: **sunflower, farmyard manure, fertilizers and plant population, yield maximization**

INTRODUCTION

Sunflower is one of the important oilseed crops and its oil is generally considered as premium oil and fetches higher value in the market because of its light colour and high level of poly unsaturated fatty acids (PUFA). Since, in India it is cultivated in an area of 0.9 m.ha, with total annual production of 0.63 m. tonnes and productivity of 696 kg per ha (Anonymous, 2012). The crop has the potential to yield at least 1,000 kg/ha under rain fed condition, with proper care. Under assured rainfall situations, the yield can be increased up to 2000 kg/ha. The major con-

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straints are inadequate and imbalanced crop nutrition and poor maintenance of optimum plant population.

Keeping these points in view a field experiment entitled "Standardization of best management practices for yield maximization in sunflower" was conducted at Zonal Agricultural Research Station, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bengaluru, during *kharif* 2011.

MATERIALS AND METHODS

Soil texture of the experimental site red sandy loam with 201 kg available nitrogen/ha, 19 kg available phosphorus/ha and 175 kg available potassium/ha. Available sulphur, zinc and boron status of the soil was 14, 0.84 and 0.25 ppm, respectively.

A Field Experiment Conducted at ZARS GKVK Bengaluru in a split plot design with three replications. Two levels of FYM (control & 5 t/ha) in main plot and factorial combination of three plant populations (P_1-55555 plants/ha, P_2-37037 plants/ha and P_3-74074 plants/ha) with three fertilizer levels (F_1-100% RDF, F_2-125% RDF, F_3-133% RDF) were assigned to subplots. Limiting nutrients (S, Zn, B) were applied as blanket recommendation based on soil test values. Half the dose of nitrogen and full dose of phosphorus and potassium and limiting nutrients were applied as basal dose as per treatments. Remaining 50 percent nitrogen was top dressed at 30 days after sowing. The crop was sown on July 17th 2011. The crop received good rainfall throughout the crop duration. Normal weather conditions are prevailed during the crop growth.

Observation on dry matter, head diameter, test weight, seed yield, oil yield were recorded at the time of harvesting and the data is subjected for F test 5% level of significance as per the procedure outlaid by Gomez and Gomez (1984) and 't' test as worked whenever 'F" test found significant. The economics were worked considering the prevailing market price.

RESULTS AND DISCUSSION

Effect of application of FYM

The data (Table 1) revealed that application of FYM did not influence the seed yield significantly. Higher seed yield (2215 kg/ha) was recorded with the application of FYM (5 t/ha) compared to control (2095 kg/ha).

The higher seed yield due to application FYM (5 t/ha) might be attributed to higher leaf area index (0.87, 4.29, 2.8) as compared to control (0.75, 4.28, 2.7) at 30, 60 and 90 DAS, respectively.

The, yield difference between FYM application and control could be attributed to numerical variation in other yield components such as higher leaf area, test

weight and yield per plant. All these components recorded higher values (5.86 g, 62 g, respectively) with application of FYM (5 t/ha) as compared to control (5.83 g, 61 g respectively). Similar trends were also observed with respect to oil yield. These results are in conformity with Jayaramaiah *et al.* (2005).

Table 1: Effect of FYM, plant population levels and different fertilizer levels on growth and yield of sunflower

Treatments	Leaf Area Index			Dry Matter	Head diameter	Test weight	Seed Yield	Seed yield	Oil yield
	30 DAS	60 DAS	90 DAS	(g/plant)	(cm)	(g/100 seeds)	(g/plant)	(kg/ha)	(kg/ha)
Farmyard manure (FYM)									
M_1-No FYM (Control)	0.75	4.28	2.6	149	17.5	5.83	61	2095	844
M_2- FYM (5 t/ha)	0.87	4.29	2.5	150	16.4	5.86	62	2215	900
S.Em.±	0.01	0.13	0.08	1.54	0.26	0.07	1.6	100	38.8
$LSD_{0.05}$	0.06	NS	NS	NS	NS	NS	NS	NS	NS
Plant population (plants/ha)									
P_1-55555 (60 x 30 cm)	0.90	4.66	2.4	146	16.5	5.72	57	2140	867
P_2-37037 (60 x 45 cm)	0.50	3.13	2.4	173	18.2	6.27	73	2036	821
P_3-74074 (60 x 22.5 cm)	1.03	5.08	2.8	129	16.2	5.54	56	2289	928
S.Em.±	0.036	0.17	0.07	1.94	0.35	0.11	3.5	50	22.0
$LSD_{0.05}$	0.10	0.50	0.21	5.6	0.99	0.31	10	146	64
Fertilizer level (RDF= 90:90:60 NPK kg/ha)									
F_1- 100 % RDF	0.83	4.02	2.3	141	16.5	5.67	61	2146	875
F_2- 125 % RDF	0.86	4.31	2.8	142	17.1	5.91	60	2134	861
F_3- 133 % RDF	0.73	4.53	2.5	165	17.3	5.95	64	2185	880
S.Em.±	0.036	0.17	0.07	1.94	0.35	0.11	3.5	50	22.0
$LSD_{0.05}$	0.10	NS	0.21	5.6	NS	NS	NS	NS	NS

Note:

-Farm yard manure (M), M_1- No FYM, M_2-FYM 5t/ha, Plant Population (P) - P_1-55555 plants/ha, P_2-37037 plants/ha, P_3-74074 plants/ha, Fertilizer levels (F) - F_1-100% RDF, F_2-125% RDF, F_3-133% RDF.

Effect of plant population

The higher plant population (74074 plants/ha) recorded significantly higher seed yield (2289 kg/ha) compared to both recommended plant population of 55555 plants/ha (2140 kg/ha) and reduced plant population of 37037 plants/ha (2036 kg/ha). This is in conformity with the findings of Patel and Thakur (2003).

Leaf area is most important indices in photosynthesis, in plant population experiments, which is meaningfully interpreted in terms of LAI. Significantly higher LAI (1.03, 5.08, 2.80 at 30, 60 and 90 days after sowing, respectively) was recorded in higher plant population 74074 plants/ha, as compared to lower plant population 37037 plants/ha (0.5, 3.13, 2.4 at 30, 60 and 90 days after sowing, respectively).

Though significantly higher head diameter (18.2 cm) and test weight (6.27 g) and per plant productivity (73 g) was recorded with reduced (37037 plants/ha)

plant population, it could not compensate the yield that was achieved under high plant population 74074 plants/ha (2289 kg/ha).

By increasing plant population level from 55555 to 74074 has not resulted in any reduction in per plant productivity. The per plant productivity of 55555 and 74074 plants/ha were almost similar (57 and 56 g, respectively). Higher per plant productivity coupled with higher plant population might be the main reason behind higher productivity in 74074 plants/ha. The similar per plant yield with 55555 and 74074 plants/ha is attributed to non significant difference in yield parameters such as head diameter (16.5 and 16.2 cm) and test weight (5.72 and 5.54) between 55555 and 74074 plants/ha, respectively. Under lower plant population levels resources might not have been used effectively due to lower leaf area index. These results are in conformity with those obtained by Intodia and Tomar (1997) and Satish Kumar *et al.* (2011).

Effect of fertilizer levels

Although seed yield differences due to graded levels of fertilizers were non significant, the higher seed yield (2185 kg/ha) was recorded with application of 133% RDF (120:120:80 kg N: P_2O_5:K_2O/ha). This is in conformity with findings of Chaudhari *et al.* (1978).

Yield components such as head diameter (17.3 cm), test weight (5.95 g) and seed yield/plant (64 g) were higher with application of 133% RDF, which might have contributed for higher grain yield. This is in conformity with the findings of Chitale *et al.* (2004).

The seed yield and yield components are indirectly influenced by different growth parameters like dry matter production and leaf area index. Application of 133% RDF has recorded higher dry matter production (165 g/plant) as compared to application of 100% RDF (141 g/plant) at harvest which might have resulted in increased yield with application of 133% RDF.

Leaf area index also recorded higher values (4.53 and 2.50) with application of 133 % RDF as compared to 100% RDF (4.02 and 2.30) at 60 and 90 days after sowing, respectively. This lower LAI might have caused the crop for producing lower total dry matter with 100% RDF and it was reflected in terms of yield parameters also.

Interaction effect

The results (Table 2) revealed that application of 5 t FYM along with 133 percent RDF at higher plant population level 74074 plants/ha recorded higher seed yield (2478 kg/ha). With same level of plant population and FYM, by decreasing the fertilizer level from 133% to 100% of RDF has at par in seed yield (2464 kg/ha). Oil yield at 100% RDF along with 5 t FYM/ha at plant population level of 74074 plants/ha (1014 kg/ha) was higher as compared to application of 133% RDF at same level of plant population and FYM. Hence, application of 100 percent RDF and 5 t FYM

along with plant population of 74074 plants/ha is sufficient to get higher oil yield (1014 kg/ha).

Economics

Higher B:C ratio (3.29) and net returns (Rs. 51450/ha) were realised due to application of FYM (5 t/ha) and 100% RDF at plant population level of 74074 plants /ha (Table 2). Higher net returns and B:C ratio was achieved due to lower cost of cultivation (Rs. 22481/ha) and higher gross returns (Rs. 73931/ha).

Table 2: Seed yield, oil yield and economics of sunflower as influenced by application of FYM, plant population levels of fertilizer levels

Treatments	Seed yield	Oil yield	Cost of cultivation	Gross * return	Net return	B:C ratio
	(kg/ha)	(kg/ha)	(Rs./ha)	(Rs./ha)	(Rs./ha)	
$M_1P_1F_1$	2063	840	19471	61898	42427	3.18
$M_1P_1F_2$	2074	833	20327	62241	41914	3.06
$M_1P_1F_3$	2131	865	20601	63950	43349	3.10
$M_1P_2F_1$	2129	872	19056	63888	44832	3.25
$M_1P_2F_2$	1852	738	19912	55586	35674	2.79
$M_1P_2F_3$	2177	864	20186	65316	45130	3.23
$M_1P_3F_1$	1950	778	19981	58507	38526	2.92
$M_1P_3F_2$	2227	904	20831	66813	45976	3.20
$M_1P_3F_3$	2251	899	21111	67546	46435	3.20
$M_2P_1F_1$	2057	848	21971	61709	39738	2.81
$M_2P_1F_2$	2321	931	22827	69645	46818	3.05
$M_2P_1F_3$	2190	885	23101	65717	42616	2.84
$M_2P_2F_1$	2212	894	21556	66373	44817	3.07
$M_2P_2F_2$	1965	798	22412	58958	36546	2.63
$M_2P_2F_3$	1879	756	22686	56381	33695	2.48
$M_2P_3F_1$	2464	1014	22481	73931	51450	3.29
$M_2P_3F_2$	2364	960	23337	70933	47596	3.04
$M_2P_3F_3$	2478	1011	23611	74336	50725	3.14
S.Em±	124	54.6	3721	3721	2631	0.17
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS

* Market price of sunflower seed Rs. 3000/q.

Note:

-Farm yard manure (M), M_1- No FYM, M_2-FYM 5t/ha, Plant Population (P) - P_1-55555 plants/ha, P_2-37037 plants/ha, P_3-74074 plants/ha, Fertilizer levels (F) - F_1-100% RDF, F_2-125% RDF, F_3-133% RDF.

Thus it can be concluded that application of 100 per cent RDF and FYM (5 t/ha) with 74074 plants/ha is sufficient to get higher economic yields in sunflower.

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NOTES

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