https://doi.org/10.29321/MAJ.10.A01906

Madras agric. J.78 (9-12) Sep-Dec-1991

EFFECT OF DIFFERENT LEVELS OF NITROGEN, SPACING AND INTERCROPS ON THE GROWTH, YIELD AND QUALITY OF SUNFLOWER (*Helianthus annus L*)

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ABSTRACT

A field experiment was conducted at the research farm college of Agriculture, Dapoli (Maharashtra) during *rabi* season of 1982, to study the effect of different levels of N, spacing and intercrops on the growth, yield and quality of sunflower, Cv.Ec 68414. The results revealed that under the prevailing agro-climatic conditions of konkan, a dose of 60 kg.ha^{-1} N was found suitable for sunflower crop during *rabi* season. Since the response to N was graded and significant, there is scope to increase a dose of N beyond 60 kg.ha^{-1}. A sunflower crop can be sown at the distance of 30 x 30 cm or 45 x 30 cm. Though the intercrops viz; Indian bean (*Dolichos lablab* L.) and blackgram (*Phaseolus mungo* L.) were found compititive with the main crop of sunflower, the total productivity due to these crops was increased substantially.

KEY WORDS : Sunflower, Nitrogen Levels, spacing, Intercrops, Yield.

The basic idea of intercropping is to exploit the resources of two or more species grouped together better, than either of grown separately. When two or more crops occupy the same field, the inherent risk in agriculture is buffered to some extent called as "biological insurance". Besides, it includes an agumentation of economic returns, improvement in physical and chemical properties of soils, control of weeds, reduction in pests and diseases, and balanced nutrition etc. Thus, one of the important strategies in oil seed and pulse production in the konkan region where irrigation water is very scarce during *rabi*-cum-hot weather season, may intercropping of sunflwer with pulses like Indian bean and Blackgram with the same amount of availalbe resources. The experiences and experimentations showed that the pulse crops like Indian bean and Blackgram can be grown successfully during *rabi* season in the Konkan tract. However, this particular combination has not been so far tried on field scale for its suitability. The present investigation was therefore, planned to investigate the feasibility of growing sunflower intercropped with Indian bean (*Dolichos Lablab* L.) and blackgram (*Phaseolus mungo* L.) in order to improve crop productivity and restore soil fertility with balancing monetary and non monetary inputs.

MATERIALS AND METHODS

The field experiment was conducted at the research farm of Agriculture college, Dapoli (Maharashtra) during *rabi* season of 1982-1983. Three levels of N namely 0, (N_0), 40 (N_1) and 60 (N_2) kg.ha^{-1} were selected along with three spacing for main crop viz; 30 x 60 cm (S_1), 30 x 45 cm (S_2) and 30 x 30 cm (S_3). The two intercrops used were blackgram (C_1) Cv. T-9 and Indian bean Cv. No.1 with one control treatment of sole crop of sunflower (C_0). The experiement was laid out in randomized block design (factorial) with the gross plot size of 6.3 x 4.5 m and net plot size of 5.40 x 3.90 m. Thus 27 treatment combinations were replicated twice. The sunflower crop Cv. EC-68414 was sown by dibbling method on 3-12-1982 along with two intercrops. The intercrops were sown in alternate rows with the main crop of sunflower. The *kharif* crop of rice in the said plot was grwon from 20th June to 23rd October, 1982.

Nitrogen in the form of urea was applied in two equal split doses as per the treatments. Recommended dose of P_2O_5 (25 kg.ha^{-1}) was applied as a basal at sowing time to all the three treatments through single super phosphate. Six irrigations were given to the crop till maturity. A depth of 60 mm water was applied irrigtion^{-1} at 14 to 15 days interval. Soil was predominantly lateritic (Alfisols) with pH value of 6.2 and coarse in texture.

RESULTS AND DISCUSSION

The data presented in Table.1 indicated that N fertilization had significant effect on the growth characters of sunflower crop. Differences were visible from 30 days onwards. The increase in height and number of leaves reflected in significant increase in dry matter production (DMP) at all the stages of crop growth. Maximum DMP was recorded at harvest. The response to N was graded and significant upto 60 kg.ha^{-1}. Serveral workers have reported that N application increased the plant height, number of functional leaves and DMP plant^{-1}. (Sonune, 1973; and Andhale and Kalbhor, 1980). Beneficial effects of N fertilization is to enhance the yield contributing characters. Diameter of disc, weight of grains plant^{-1}, total number of grains disc^{-1} and test weight were significantly increased by N application upto 60 kg.ha^{-1} and the results are in accordance with the result obtained by Suraj Bhan (1977).

Favourable effects of N fertilization on vegetative growth and yield contributing characters were ultimately reflected on increased grain yield. There was increase in grain yield by 155 and 30 per cent due to 60 and 40 kg.ha^{-1} N, respectively, when compared with control treatment (N_0). Similar results were reported by Suraj Bhan (1977) and Singh and Pacheria (1981).

The data on quality studies of sunflower grains presented in Table 2 showed that the application of N at 60 kg.ha^{-1} had significantly reduced the oil content in sunflower grains. However, total oil yield was maximum at the highest N level of 60 kg.ha^{-1} followed by 40 kg.ha^{-1} N and control treatment. This was due to the fact that the grain yield ha^{-1} was highest at higher levels of N.

It is seen from Table 1 that plant height of sunflower decreased with wider spacing (60x30cm) and increased at the narrow spacing (30x30cm). However, wider spaced (60x30cm) plants produced more number of leaves plant^{-1}. The trend in DMP plant^{-1} was found in decreasing order S1>S2>S3. These findings are in close conformity with the results of Srinivas and Patil (1978).

Under wider spacing, favourable effect on vegetative growth was manifested by increased diameter of disc, weight of grains plant^{-1} and thousand grain weight. All these yield components decreased with increasing density of plant ha^{-1}. However, the grain yield was significantly maximum at the closer (S_3) spacing as compared with wider spacing (S_1). Differences between S_3 and S_2 and S_2 and S_1 were found at par with each other. This increase in grain yield at narrow spacing (S_3) may be due to the maximum plant population unit area^{-1}. Similar results were reported by Alessi and Powar (1970)). Oil percentage in grain did not affect significantly by various spacings. These results are in accordance with the results obtained by Ramaswamy *et al.* (1974).

The data in Table 1 showed that different intercropping treatments had adverse effect on the various growth characters and yield contributing characters of the main crop. This has finally reflected on decreased grain yield of sunflower by 11 and 46 per cent due to intercropping of blackgram and Indian bean respectively when compared with sole crop of sunflower. This reduction in grain yield was mainly due to decrease in weight of disc, diameter of disc, weight of grains disc^{-1} and decrease in test weight by

various intercropping treatments. Thus, both the intercrops namely blackgram and Indian bean were found competitive with the main crop of sunflower. These results are in close conformity with the results reported by Singh and Singh (1977). Data presented in Table 2, clearly indicated that the treatments viz; Sunflower + Indian bean (C_2) and Sunflower + blackgram (C_1) produced significantly more combined grain yield to the tune of 15.16 and 10.24 q.ha^{-1}, respectively. This yield was 48 and 33 per cent more respectively over the sole crop treatment (C_0). Similarly, the treatment C_2 was significanlty superior to C_1.

Different intercropping treatments did not affect the oil percentage in sunflower grain significantly. Tano (1966) also noticed that there was no significant reduction in oil content of sunflower by intercropping with beans. However, the total oil yield was adversly affected by intercropping treatments as maximum grain yield was recorded by the sole crop of sunflower. In general, Indian bean and blackgram intercropping with sunflower seemed to be quite successful and beneficial as the total productivity unit area^{-1} has increased significantly.

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Table 1. Various growth characters of sunflower as affected by different levels of nitrogen, spacing and intercropping treatments.

Sr. No.	Days after sowing	Levels of nitgrogen					Levels of spacing					Intercropping				
		N_0	N_1	N_2	S.E.	C.D. (5%)	S_1	S_2	S_3	S.E.	C.D. (5%)	C_0	C_1	C_2	S.E.	C.D. (5%)
1. Mean height plant^{-1} (cm) :																
i)	30	22.19	24..35	26.51	0.62	1.79	23.81	25.03	24.21	0.62	N.S.	24.63	24.64	23.78	0.62	N.S
ii)	45	62.74	73.77	76.25	0.76	2.21	70.18	69.80	72.78	0.76	0.21	74.58	71.13	67.04	0.76	0.21
iii)	60	89.16	110.75	137.36	0.61	1.77	106.29	113.16	117.83	0.61	1.77	117.13	112.28	137.87	0.61	1.77
iv)	75	104.59	132.43	154.00	0.14	0.41	124.74	130.46	136.33	0.14	0.41	136.66	130.06	124.81	0.14	0.41
v)	90	108.77	138.23	160.52	0.35	1.00	129.58	135.52	142.42	0.35	1.00	142.31	135.11	130.10	0.35	1.00
vi)	at harvest	109.91	139.39	161.73	0.41	1.20	130.87	136.55	143.61	0.41	1.20	143.58	136.16	130.28	0.41	1.20
2. No. of functional leaves plant^{-1}																
i)	30	6.01	7.02	7.11	0.10	0.29	7.02	6.69	6.43	0.10	0.29	6.62	6.99	6.53	0.10	0.29
ii)	45	9.21	12.32	12.38	0.24	0.70	11.89	11.29	10.73	0.24	0.74	11.39	11.73	10.79	0.24	0.70
iii)	60	11.92	15.71	15.92	0.36	1.05	15.50	14.44	13.61	0.36	1.05	14.23	15.33	13.99	0.36	1.05
iv)	75	12.48	13.68	14.48	0.39	1.13	14.00	13.67	12.97	0.39	N.S.	13.66	13.78	13.20	0.39	N.S.
V)	90	8.02	8.49	10.50	0.62	1.81	9.61	8.90	8.50	0.62	N.S.	9.02	9.24	8.24	0.62	N.S.
3. Mean dry matter production plant^{-1} (g) :																
i)	30	6.49	6.96	6.93	0.03	0.08	6.87	6.82	6.69	0.03	0.08	6.84	6.79	6.75	0.03	N.S.
ii)	45	21.69	28.57	30.53	0.18	0.52	27.73	26.81	26.25	0.18	0.52	27.31	29.90	26.58	0.18	0.52
iii)	60	44.68	51.23	55.58	0.47	1.38	52.72	50.86	47.90	0.47	1.38	51.75	50.73	49.01	0.47	1.38
iv)	75	65.20	71.60	75.48	0.45	1.31	72.66	71.22	68.40	0.45	1.31	71.76	71.18	69.35	0.45	1.31
v)	90	75.31	81.87	85.75	0.35	1.01	82.81	81.31	78.83	0.35	1.01	81.95	81.36	79.64	0.35	1.01
iv)	at harvest	80.44	87.29	91.11	0.46	1.33	88.72	86.20	83.93	0.46	1.33	87.51	86.21	85.12	0.46	1.33

Table 2. Diameter of sunflower disc, weight of grain disc^{-1}, total number of grains disc^{-1}, one thousand grain weight, grain yield, and oil yield as affected by different treatments.

Treatments	Diameter of disc(cm)	Weight of grains (g) disc^{-1}	Total No.of grains^{-1} disc^{-1}	Thousand grain weight (g)	Grain Yield of sunflower (q.ha^{-1})	Combined grain yield (Main crop+ Inter crop) (q.ha^{-1})	Oil percentage in sunflower grain	Oil yield (kg.ha^{-1})
I. Nitrogen :								
N0	7.68	6.01	389.24	31.46	2.89	9.46	45.74	131.99
N1	11.39	12.17	531.47	42.72	7.39	11.82	43.89	325.07
N2	13.02	18.31	598.59	48.62	9.62	11.84	41.11	398.55
SE	0.26	0.14	2.21	0.77	0.24	0.47	0.94	13.38
C.D. (5%)	0.77	0.41	6.42	2.24	0.70	1.37	2.72	38.89
II. Spacing								
S1	11.43	12.59	507.43	43.44	6.67	10.64	43.33	260.58
S2	10.58	12.14	509.76	40.47	6.72	10.67	43.89	292.98
S3	10.08	11.76	502.11	38.88	7.11	11.81	43.52	302.05
S.E.	0.26	0.14	2.21	0.77	0.24	0.47	0.94	13.38
C.D. (5%)	0.77	0.41	N.S.	2.24	0.70	N.S.	N.S.	N.S.
III. Intercropping								
C0	10.69	12.52	519.10	41.77	7.70	7.70	44.81	341.64
C1	10.68	12.17	503.53	40.32	6.93	10.24	43.33	293.64
C2	10.53	11.79	496.67	40.71	5.26	15.16	42.59	220.33
S.E.	0.26	0.14	2.21	0.77	0.24	0.47	0.94	13.38
C.D. (5%)	N.S.	0.41	6.42	N.S.	0.70	1.37	N.S.	38.89

N.S - Not significant.