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A STUDY ON THE YIELD AND YIELD ATTRIBUTES OF SUNFLOWER VARIETY 'PEREDOVIK' AS AFFECTED BY GRADED DOSES OF NITROGEN AND PHOSPHORUS

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Fertilizer response of sunflower has been variable it being in general, better in poorer soils (Weibel, 1951). Singh and Singh (1972) reported that in trials at Pantnagar 40-80 kg nitrogen per hectare gave higher yields of sunflower compared to no nitrogen application. Singh *et al* (1973) found that the nitrogen requirement of sunflower crop could be met with 60 kg nitrogen per hectare under average fertility conditions. Gaur et *al* (1973) found that sunflower seed yield increased progressively with increasing dose of phosphorus up to 50 kg phosphate per hectare. Vranceanu (1970) concluded that for sunflower, phosphorus was the most effective element and has recommended a dose of 60 to 90 kg phosphorus per heetare. The present experiment was undertaken to study the fertilizer requirement of sunflower variety 'peredovik' in red loam soil of Kerala and to assess the possible interaction between the nutrients, nitrogen and phosphorus.

Materials and Methods

The experiment was conducted in the farm attached to the College of Agriculture. Vellayani during the period from February to May 1973 under irrigated condition. The soils of the experimental site is red loam in texture. Soil analysis showed a total N content of 0.046%, total and available P_2O_5 of 0.042% and 0.0071% respectively, and a pH of 5.4. The treatments consisted of 3 levels nitrogen (0,45 and 90 kg N/ha) and 4 levels of phosphorus (0,30.60 & 90 kg P_2O_5/ha). The experiment was laid out in Randomised Block Design with three replications. Half of the nitrogen dose and the full dose of phosphorus along with a common dose of 40 kg K_2O/ha were applied at the time of planting. The remaining half of the nitrogen was top dressed one month after planting. Spacing adopted was 30 cm between rows and 15 cm between plants. Heads from individual net plots were harvested, air dried, and threshed for the record of grain yield. Oil content of seeds of samples from individual plots was also recorded. A random sample of four plants was drawn from individual plots for recording yield components.

Results and Discussion

The treatment effects were studied on characters such as head diameter, number of seeds per head, 1000 seed weight, percentage of filled aeeds, total

yield of seeds, total yield of stover, percentage of oil content and protein content of seeds. The yield optimum of nitrogen was also worked out. The results are summarised in Table-1.

Yield components

1. *Head diameter*:- There was a conspicuous and significant increase in head diameter with the incremental doses of nitrogen. The level, 90 kg N/ha gave the maximum head diameter (7.4 cm) and was significantly superior to 45 kg N/ha (5.96 cm) which in turn was superior to the control of no nitrogen application (3.56 cm).

Neither the effect of phosphorus nor the NP interaction was found significant.

2. *Number of feeds per head*:- The effect cf nitrogen was significant in increasing the number of seeds per head. Maximum number of 306 seeds/head was recorded at 90 kg N/ha followed by 230 seed /head at 45 kg/ha and then by the control of no nitrogen application which recorded only 138 seeds/head. The differences between all the three levels were significant. The significant increase in number of seeds per head might be due to the net result of the enhancement in growth attributes like leaf area and dry matter accumilation. The lack of response to phosphorus can be traced to the comparatively high status of available phposphorus in soil.

3. *Percentage offilled seeds* - Contrary to the effect of nitrogen on other yield attributes, an inverse relationship was apparent between levels of applied nitrogen and percentage of filled seeds. Nitrogen at 90 kg/ha recorded lower percentage of filling, as compared to 45 kg N/ha which in turn was found to be inferior to the zero level. As will be clear from the Table, nitrogen application has significantly increased the head diameter and number of seeds. This was probably brought about by enhanced leaf growth and hence rate of photosynthesis. The fact that a negative response was observed in percentage of filled seeds points to the fact that photosynthesis during the post flowering period could not ensure adequate supplies of carbohydrates to the developing seeds. An environmental factor that probably facilitated inadequate rates of photosynthesis at seed development period was the amount of solar radiation. There had been rains from last week of March '73 when the crop was in the flowering and post-flowering stages and the atmosphere remained cloudy thus adversely affecting seed filling.

Effect of P and the interaction of NP were not found significant.

4. *Thousand seed weight*:- Nitrogen at both 45 kg/ha and 90 kg/ha was found to have a marked influence on 1000 seed weight. The maximum

Table 1

Effect of nitrogen and phosphorus on yield components, **yield** and quality of **sunflower**

Treatments	Head diamecer (cm)	Number of seeds per head	Percentage of filled seeds	1000 seed weight (g)	Yield of seeds kg/ha	Oil content of seed (%)	Protein content of seeds (%)
Nitrogen kg/ha							
0	3.56	138.33	52.50	34.09	563.44	34.59	18.47
45	5.96	229.75	45.92	51.94	1259.46	37.55	21.46
90	7 40	305.92	40.50	76.75	1467.79	36.01	25.25
F lest.	sig.	sig.	sig.	sig.	Sig.	sig.	Sig.
S. Em ±	0.29	16.14	0 557	0.54	64.06	0.52	0.801
D. (0.05)	0.85	47.33	1.632	1.58	187.83	1.524	2.35
Phosphorus kg P_2O_5/ha							
0	5.35	199,67	45.00	51.14	1041.66	35.68	20.31
30	5.38	209.22	47.00	52.75	1103.21	35.95	21.32
60	6.13	243.67	47.78	56.02	1264.19	36.52	23.01
90	5.71	246.11	45 44	57.12	980.10	36.05	22.26
F test.	N.S.	N. S.	N. S.	sig.	N S.	N. S.	N. S.
S. Em ±	0.136	18.65	0.643	0.63	73 96	0 601	0.937
C. D. (0.05)				1.85			

weight of 76.75 g was recorded at 90 kg N/ha and was significantly superior to 45 kg N/ha which in turn was superior to the zero level of nitrogen.

It is also seen that phosphorus at levels 90 kg and 60 kg P_2O_5/ha which were on par in terms of 1000 seed weight were significantly superior to **0 and** 30 kg P_2O_5/ha which also were statisticaily at par. A comparison of the data on yield of seeds in the Table-1 will indicate that the beneficial effect of phosphorus on test weight was not of as much quantitative magnitude as to significantly improve final yield.

The combined effect of nitrogen and phosphorus was also found significant (Table-2). Plots receiving no nitrogen and no phosphorus were significantly inferior to the other three treatment combinations, there being no significant difference between pho phorus levels of 30 and 90 kg P_2O_5/ha. In plots receiving 45 kg N/ha, significant differences were noticed between 30 and 60 kg P_2O_5/ha only. The difference between treatments of no phosphorus supply and

Table 2

Combined effect of nitrogen and phosphorus on 1000 seed weight of sunflower

Levels of N	Levels of P_2O_5				
	0	45	60	90	Mean
0	30.09	34.94	34 58	36.74	34.09
45	47.90	46.96	56.66	56.24	51.94
90	75.43	76.36	76.82	78.38	76.75
	51.14	52 75	56.02	57.17	
S. E. m ±	1 .08	C. D 5%	3.17		

that at 30 kg/ha, and the difference between 60 and 93 kg P_2O_5/ha were non-significant at this nitrogen level. At 9'J kg N/ha no significant difference between levels of phosphorus was noticed.

Yield of seeds

The data on yield are presented in Table-1. The results reveal that application of graded doses of nitrogen up to 90 kg per hectare has recorded significant increase in yield of seeis. The highest mean yield of 1463 kg ha observed at 90 kg N/ha was 150 per cent higher than that of control. The percentage of yield increase obtained up to 45 kg N/ha was 123.

The marked increase in yield obtained up to 90 kg level of N shows that the nitrogen requirement of the sunflower variety 'Peredovik' is much higher than inherent nitrogen supplying power of soil. The increased growth attributes like leaf area due to higher levels of nitrogen application might have resulted in producing positive response in seed yield to levels of nitrogen. The highest mean head diameter. number of seeds/head and seed weight were also noticed at 90 kg N ha followed successively by 45 kg N/ha and then by control of no nitrogen supply. The yield due to nitrogen might thus be attributed to the combined effect of all these yield components. The unfavourable effect brought about by the single yield component ie. persentage of filled seeds was more than compensated by the favourable combined influence of the other yield attributes. Similar increase in sunflower yield by varying levels of nitrogen have been reported by Rollier, 1970; Vranceanu. 1970; Singh and Singh 1972; Gaur *et al* 1973: and Singh ft *al* 1973.

The effect of phosphorus and that due to the interaction remained non-significant indicating thereby that supply rates of soil phosphorus were adequate

enough to sustain sunflower growth even upto the highest level of nitrogen supply.

The quadratic response curve fitted to the data as a function of levels of nitrogen is furnished below:

$$Y = -0.000254\ N^2 + 0.04408\ N + 1.90$$

The optimum dose for the variety calculated by using the formulae $-\frac{b}{2a}$ Was found to be 86.77 kg/ha of nitrogen where 'b' and 'a' respresent parameters in the regression equation.

Oil content of seeds

The percentage of oil for various treatments are presented in Table -1 It is evident that nitrogen application has significant influence on oil contents of seeds. The lowest value of 34.49 per cent was noticed for the treatment with no nitrogen application. The treatment which received nitrogen at 45 kg level recorded maximum oil content of 37.55 per cent. At the highest level of nitrogen application ie. 90 kg/ha there was a significant reduction In the oil content as compared to the next lower level. Lowest oil content noticed for the control plot is attributable to the lack of proper development of kernels inside the seeds due to the insufficient supply of nitrogen for seed development. The decline in oil content beyond a certain level is in agreement with the finding of Simanskii (1961), D'Jakov (1966) and Onishchenko (1968). It may be noted that seed yield increased up to the highest nitrogen level tried and though the total oil yield also was highest in this treatment, the dilution of synthesised lipids over a larger amount of kernels brought down its percentage content. No significant effect could be noticed for the effect of phosphorus on oil content.

Protein content of seeds

Mean values of protein content of seeds for different levels of nitrogen and phosphorus are given in Table 1. The highest protein content of 25.25% was recorded at 90 kg N/ha which was significantly higher than 21.46% noticed at 45 kg N/ha and 18.47% noticed for the treatment of no nitrogen application. The Superiority of higher levels of nitrogen in increasing the protein content of sunflower has been roported by Onishchenko (1968) and Rollier (1970). Effect of P and that of interaction between N and P were not significant.

Summary

A field experiment was conducted during the year 1973 to study the effect of graded doses of nitrogen and phosphorus on yield of seeds and

oil content of sunflower variety 'Peredovik'. Nitrogen application up to 90 kg/ha helped in increasing the total yield of seeds but reduced the percentage of oil. Phosphorus application was found to have no significant influence.

സംഗ്രഹം

'പെരഡോവിക' എന്നയിനം സൂര്യകാന്തിച്ചെടിക്ക്, നൈട്രജൻ, ഫോസ്ഫറസ് എന്നീ മൂലകങ്ങളും പല അളവുകളിൽ നല്കിയാൽ ഉണ്ടാകാവുന്ന ഫലങ്ങളും പഠിക്കുന്നതിനു വേണ്ടി 1973-ൽ കാർഷിക കോളേജിൽ ഒരു പരീക്ഷണം നടത്തുകയുണ്ടായി. ഹെക്ടറിന് 90 കി. ഗ്രാം വരെ നൈട്രജൻ ചേർത്തപ്പോൾ വിത്തുല്പാദനം വർദ്ധിച്ചതായും എന്നാൽ എണ്ണയുടെ ശതമാനം കുറഞ്ഞതായും കണ്ടു. ഫോസ്ഫറസ് പ്രയത്തക്ക പ്രതികരണം ഒന്നും ഉളവാക്കിയില്ല.

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