# EFFECT OF NITROGEN, PHOSPHORUS AND PLANT POPULATION ON SUNFLOWER AND SUBSEQUENT RESIDUAL EFFECT ON MUNG AND RICE CROPS.

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## SUMMARY

A field experiment on levels of nitrogen, phosphorus (0, 40 and 80 kg/ha) and their combinations and plant population (55.5, 74.0 and 1, 11.0 thousand plants/ha) was conducted in the university farm during winter season of 1980-81 and 1981-82. The experiment was conducted in split plot design where nutrients were allocated to main plot and plant population to sub plot. Seed yield, stalk yield, oil yield, number of filled seeds/head, head diameter and 1000 seed weight were significantly increased with increase in level of N or P. Seed, stalk and oil yields were higher at 1, 11 thousand plant population, followed by 74 thousand and it was lowest at 55.5 thousand plants/ha. The yield attributes were significantly higher at 55.5 thousand plants/ha and it was lowest at 1, 11 thousand plants/ha. Application of phosphorus to sunflower crop showed a significant residual effect on mung grown as first residual crop. There was not much variation in yield and yield attributes of rice grown as a second residual crop.

## INTRODUCTION

Oilseeds play an important role in agricultural economy of India. To meet the increasing demand for vegetable oil due to increased population, higher standard of living and high demand of oil from the vegetable oil consuming industries, India has to import appreciable quantity of edible oil and oilseeds from other countries. Sunflower was introduced in this country to supplement the oilseed production in addition to traditional oilseeds like ground nut, rape and mustard, sesame etc. Now, sunflower is an established oilseed in crop in Southern, Central and Western part of India. In this investigation, an attempt was made to study the effect of nitrogen and phosphorus in different combination and plant population on yield and yield attributes of sunflower crop. Residual effect of fertilizers and plant population was also studied on subsequent mung (green gram) and upland rice crops.

## MATERIALS AND METHODS

The experiment of sunflower was conducted in the university farm during winter season of 1980-81 and 1981-82 in split plot design winter season of 1980-81 and 1981-82 in split plot design where fertilizers were allocated to main plots and plant population to sub plots. The soil of the experimental field had a pH 7.3, organic carbon 0.46%, total nitrogen .056%, available $P_2O_5$ 25 kg/ha and available $K_2O$ 115 kg/ha. The experiment was laid out in split plot design where nitrogen and phosphorus treatments

(0, 40 and 80 kg/ha and their combinations) were allocated to main plots and plant population (55.5, 74.0 and 1,11.0 thousand plants/ha) were allocated to subplots. Sunflower was sown in middle of November and subsequent mung and rice crops were sown in middle of March and June respectively. The varieties used were Morden for sunflower, $B_r$, for mung and IET 1444 for rice. Sunflower was harvested in first week of March, mung in first week of June and rice by end of September. Irrigation, Interculture and plant protection measures were taken as and when needed.

RESULTS

Table 1. Effect of N, P and plant population on yield of sunflower (Pooled data of 1980-81 and 1981-82)

| Treatments | Seed Yield (q/ha) | Stalk yield (q/ha) | Oil content )(Percent) | Oil yield (q/ha) |
|---|---|---|---|---|
| Nutrients | | | | |
| $N_0P_0$* | 3.56 | 16.31 | 30.16 | 1.09 |
| $N_0P_{40}$ | 5.03 | 20.00 | 35.61 | 1.79 |
| $N_0P_{80}$ | 6.78 | 20.39 | 38.27 | 2.59 |
| $N_{40}P_0$ | 8.10 | 27.00 | 35.01 | 2.84 |
| $N_{40}P_{40}$ | 11.03 | 28.61 | 38.40 | 4.23 |
| $N_{40}P_{80}$ | 14.09 | 31.28 | 40.59 | 5.71 |
| $N_{80}P_0$ | 11.12 | 37.12 | 35.57 | 4.06 |
| $N_{80}P_{40}$ | 15.02 | 37.28 | 37.76 | 5.54 |
| $N_{80}P_{80}$ | 18.61 | 42.10 | 40.78 | 7.52 |
| S.Em ± | 0.287 | 0.99 | - | 0.12 |
| CD 5% | 0.828 | 2.96 | - | 0.34 |
| Plant population in thousand/ha | | | | |
| 55.5 | 9.02 | 24.50 | 37.69 | 3.42 |
| 74.0 | 10.02 | 29.00 | 37.80 | 3.77 |
| 1,11.0 | 12.02 | 33.20 | 38.55 | 4.59 |
| S.Em ± | 0.177 | 0.47 | - | 0.08 |
| C.D. 5% | 0.499 | 1.29 | - | 0.23 |

* P = $P_2O_5$ at 0, 40 and 80 kg/ha

Data presented in Table 1 showed that application of N and P significantly influenced yield of sunflower. Seed yield and oil yield was significantly increased as the level of nitrogen was increased from 0 to 80 kg N/ha. Application of phosphorus either with N or without W significantly increased the seed and oil yield over lower levels. Stalk yield of sunflower was significantly increased when level of N was increased from 0 to 80 kg N/ha irrespective of level of P. Application of P significantly increased the stalk yield but there was no significantly difference in stalk yield between 40 and 80 kg level of $P_2O_5$ at lower level of N application. Highest yield was recorded when both or and $P_2O_5$ was applied at 80 kg/ha oil content was increased with the increase in level of $P_2O_5$ application irrespective

of level of nitrogen but there was not much variation in oil content at higher level of N application.

Seed yield, stalk yield and oil yield were higher with the increase in plant population from 55.5 thousand to 1,11.0 thousand plants/ha. Highest yield was found with 1,11.0 thousand plants/ha. There was not much variation in oil content among different plant populations (Table 1).

Table 2. Effect of N, P and plant population on yield components of sunflower (Pooled data of two years)

| Treatments | Head diameter (cm) | 1000 seed weight(g) | Number of filled seeds/head | Number of unfilled seeds/head |
|---|---|---|---|---|
| Nutrients | | | | |
| $N_0P_0$ | 9.72 | 54.63 | 82.42 | 117.75 |
| $N_0P_{40}$ | 12.63 | 58.75 | 105.61 | 120.01 |
| $N_0P_{80}$ | 12.76 | 59.64 | 150.27 | 97.97 |
| $N_{40}P_0$ | 14.41 | 59.25 | 182.44 | 156.42 |
| $N_{40}P_{40}$ | 16.73 | 61.69 | 220.86 | 157.25 |
| $N_{40}P_{80}$ | 16.93 | 60.30 | 308.46 | 142.13 |
| $N_{80}P_0$ | 19.24 | 62.91 | 227.42 | 298.76 |
| $N_{80}P_{40}$ | 18.83 | 63.01 | 320.13 | 268.60 |
| $N_{80}P_{80}$ | 19.91 | 64.40 | 392.58 | 269.41 |
| S.Em ± | 0.31 | 0.316 | 3.49 | 12.1 |
| CD 5% | 0.88 | 0.912 | 10.06 | 36.0 |
| Plant population (thousand/ha) | | | | |
| 55.5 | 17.33 | 63.94 | 283.28 | 199.82 |
| 70.0 | 15.29 | 60.20 | 208.29 | 178.23 |
| 1,11.0 | 14.43 | 57.39 | 171.82 | 164.75 |
| S.Em ± | 0.118 | 0.179 | 2.29 | 6.4 |
| C.D.5% | 0.333 | 0.508 | 6.48 | 17.2 |

Effect of N, P and their combinations on yield components of sunflower has been presented in Table 2. Application of N significantly increased head diameter, 1000 seed weight and number of filled seeds/head. Application of P increased head diameter, 1000 seed weight and number of filled seeds/head but there was no significant difference in head diameter and 1000 seed weight between 40 and 80 kg $P_2O_5$ either with N or without N. Number of filled seeds/head was significantly increased with the

the increase in level of $P_2O_5$. Both filled and unfilled seeds were higher at higher level of N and P application. Number of unfilled seeds was more when N was applied at 80 kg/ha.

Head diameter, 1000 seed weight, number of filled seeds/head was significantly decreased as the plant population was increased from 55.5 to 1,11.0 thousand plants/ha. Number of unfilled seeds/head was higher at higher plant population.

Table 3. First residual effect of N, P and plant popula-tion of sunflower on mung

| Treatment | Seed yield (q/ha) | Number of pods/plant | Number of grains/pod | Pod length (cm) |
|---|---|---|---|---|
| Nutrients | | | | |
| $N_0P_0$ | 4.59 | 21.82 | 11.30 | 5.98 |
| $N_0P_{40}$ | 5.52 | 22.91 | 11.89 | 6.05 |
| $N_0P_{80}$ | 6.75 | 28.00 | 11.95 | 6.30 |
| $N_{40}P_0$ | 4.98 | 22.96 | 11.60 | 5.99 |
| $N_{40}P_{40}$ | 5.77 | 25.12 | 11.93 | 6.20 |
| $N_{40}P_{80}$ | 6.29 | 27.28 | 12.33 | 6.32 |
| $N_{80}P_0$ | 6.03 | 25.92 | 12.46 | 6.47 |
| $N_{80}P_{40}$ | 5.23 | 24.40 | 12.43 | 6.29 |
| $N_{80}P_{80}$ | 6.79 | 28.47 | 12.36 | 6.41 |
| S.Em ± | 0.24 | 1.26 | 0.19 | 0.064 |
| CD 5% | 0.72 | 3.77 | 0.58 | 0.192 |
| Plant population (thousand/ha) | | | | |
| 55.5 | 5.78 | 26.67 | 12.58 | 6.18 |
| 74.0 | 5.78 | 25.26 | 12.32 | 6.23 |
| 1,11.0 | 5.74 | 23.70 | 11.98 | 6.11 |
| S.Em ± | 0.128 | 0.356 | .075 | 0.034 |
| CD 5% | NS | 0.987 | 0.21 | NS |

N.S. = Not significant

Residual effect of nitrogen, phosphorus and their combinations and plant population of sunflower was studied on mung crop and the data has been presented in Table 3. Seed yield of mung was significantly higher when P was applied to sunflower crop at the rate of 40 and 80 kg $P_2O_5$/ha either with N or without N. There was no residual effect of single application of N on mung yield as compared to P either single or in combination with P. Number of pods/plant, number of grains/pod and pod

length were significantly higher where P was applied to sunflower. The effects were more pronounced where P was applied to sunflower at higher level over lower level either single or in combination with N. Single application of N has no significant residual effect on yield components of mung.

Plant population of sunflower had no significant residual effect on yield of mung and pod length. Number of pods/plant and number of grains/pod were significantly higher at lower plant population (55.5 thousand plants/ha) but the number of pods/plant and number of grains/pod was decreased when plant population of sunflower was increased to 1,11.0 thousand plants/ha.

Table 4. Second residual effect of N, P and plant population on rice.

| Treatments | Grain yield (q/ha) | No.of filled seeds/panicle | Panicle length (cm) | Plant height (cm) |
|---|---|---|---|---|
| $N_0P_0$ | 13.66 | 51.33 | 18.93 | 67.58 |
| $N_0P_{40}$ | 13.80 | 50.63 | 19.90 | 71.73 |
| $N_0P_{80}$ | 14.47 | 51.70 | 19.23 | 67.48 |
| $N_{40}P_0$ | 13.48 | 50.63 | 18.00 | 65.38 |
| $N_{40}P_{40}$ | 14.61 | 54.20 | 19.14 | 71.13 |
| $N_{40}P_{80}$ | 15.35 | 54.33 | 18.86 | 68.86 |
| $N_{80}P_0$ | 13.65 | 52.95 | 18.58 | 66.15 |
| $N_{80}P_{40}$ | 14.89 | 54.85 | 18.97 | 70.26 |
| $N_{80}P_{80}$ | 15.53 | 55.76 | 18.97 | 70.87 |
| S.Em ± | 0.749 | 0.734 | 0.219 | 1.11 |
| C.D. 5% | NS | NS | 0.66 | 3.32 |
| Plant population (thousand/ha) | | | | |
| 55.5 | 14.28 | 50.92 | 18.94 | 68.55 |
| 74.0 | 14.34 | 52.86 | 19.02 | 68.43 |
| 1, 11.0 | 14.51 | 53.89 | 18.90 | 69.50 |
| S.Em ± | 0.218 | 0.345 | 0.096 | 0.533 |
| CD 5% | NS | NS | NS | NS |

There was no significant residual effect (second) of nutrients and plant population of sunflower on yield of rice. The residual effect of nutrients and plant population of sunflower retained upto mung and no profound residual effect was found in rice. But a good average seed yield ranging from 13.5-15.5 q/ha was

obtained due to inclusion of legume. Height of plant and panic length though differed due to residual effect of nutrients there was very little variation in yield.

## DISCUSSION

Application of N and P either single or in combination significantly increased the seed yield, stalk yield and oil yield of sunflower crop. This increase in yield might have resulted from significant increase in yield components such as 1000 seed weight, head diameter and number of filled seeds/head. The results are in close agreement with the findings of Nur (1975), Gangwar and Parameswaran (1976), Singh et al. (1977), Samui et al. (1982), Muirhead et al (1982), Hunter and McCosker (1982), Samui et al. (1985). Seed yield, stalk yield and oil yields were significantly higher at higher plant population (1,11.0 thousand plants/ha)over lower plant populations (55.5 thousand plants/ha). The plants of the variety Mordan being dwarf in nature, it performed better under close spacing accomodating more number of plants/ha. Hussein et al. (1980) and Vannozzi et al. (1985) also reported that higher plant population beyond 70,000 plants/ha increased seed yield over lower plant populations in shorter stemmed cultivars.

Application of phosphorus to sunflower significantly increased the yield of subsequent mung crop indicating residual effect whereas N had no residual effect. This is obvious because P is retained firmly in the soil complex after application of water soluble P and it is released slowly, whereas N is lost from soil by various processes. There was no second residual effect on rice crop the yield of rice was satisfactory though no fertilizer was applied and it was due to inclusion of a legume in the crop sequence.

## CONCLUSION

It may be concluded that 80 kg N and 40 kg $P_2O_5$ and a plant population of 1 lakh/ha may be recommended for sunflower variety mordeu.

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