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# Evaluation of Optimum and Economical Dose of Fertilizer for Groundnut Variety SP-2000

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**Abstract**
Studies were carried out on different doses of NPK fertilizers applied to groundnut variety SP-2000 sown at Agriculture Research Station (N) Mingora, Swat to evaluate the optimum and economical dose of fertilizer for groundnut cultivation in the area. Based on yield and yield components data, it was concluded that treatment T2 (25:60:60 $N:P_2O_5:K_2O$ kg/ha) gave the highest pod yield of 2490 kg/ha followed by treatment T6 (50:75:60 and T8 (50:60:75) with pod yield of 2319 and 2296 kg/ha, respectively, against the control T9 (00:00:00) which gave 1850 kg/ha. It is therefore suggested that these doses of NPK fertilizer should be recommended to the farmers in order to raise a healthy and good groundnut crop and ultimately get highest yields of pods.

## Introduction

Groundnut (Arachis hypogaea. L.) belongs to an important family leguminosae. It is an oilseed crop with 40-50% oil contents. The remaining portion can be used as meal for food or feed (25-30% proteins). As a crop groundnut ranks 13$^{th}$ in importance in the world. Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha (FAOSTAT 2011). In Pakistan it was grown on an area of 83000 hectares with a total production of 68000 tons and an average yield of 818 kg/ha. (G.O.P. 2011). In Khyber Pakhtunkhwa during the same period it was grown on an area of 7839 ha with a total production of 11151 tons and an average yield of 1422 kg/ha. (G.O.P. 2011). Groundnut is a potential crop for both rain-fed and irrigated lands of Malakand Division and can easily be adjusted in the prevailing cropping patterns. Patra *et al*., (1993) reported that the number of pods plant$^{-1}$ was effectively increased with the application of 40 kg N ha$^{-1}$ for two yeARI study in west Bengal. Praveen Rao *et al*., (1992) revealed that application of 20-30 kg N ha$^{-1}$ were at par with each other and significantly superior to 10 kg N ha$^{-1}$ and control in pod yield. Brike *et al*., (1994) concluded that pod yield increased with the application of N at 20 and 40 kg ha$^{-1}$ over the control.

Mishra (1994) reported that the highest dry pod yield of groundnut was obtained at 60 kg $P_2O_5$ ha$^{-1}$ and lowest under the control. The increase in the Pod yield over the control was 52%. Similarly, highest plant height (cm), branches/plant, shelling (%), oil (%) and 100 kernel weight were under 60 kg $P_2O_5$ ha$^{-1}$, whereas lowest under the control for all the components. These results might have been due to the maximum utilization of phosphatic fertilizer in groundnut crop. Mishra (1997) conducted fertilizer experiments with five treatments i.e., control, 50, 75, 100 and 150 percent of recommended doses of fertilizers. Application of 20**:**80**:**20 $P_2O_5$. $K_2O$ kg ha$^{-1}$ (100 % of recommended doses) resulted in 21, 10, 23 and 98% increase in pod yield over 150, 75, 50% of recommended dose and control respectively. Pod yield ha$^{-1}$, shelling percent, 100 kernel weight (g) and SMK% were also higher with this dose. In higher dose of NPK (150% of recommendation) a decline in pod yield was observed. Rajendran and Laurduraj (1998) revealed that application of 25 kg N and 50 kg P kg ha$^{-1}$ recorded significantly higher plant height and more number of branches than control. Yakadri and Satyanaryana (1995) studied the response of groundnut to varying, levels of N and P and suggested that 30 kg N and 60 kg $P_2O_5$ ha$^{-1}$ influenced the filled pods plant$^{-1}$, 100 kernel weight and shelling percent at Hyderabad.

## Materials and methods

The fertilizer trial was conducted at ARI, Mingora, Swat. Nine fertilizer treatments (including one control) with different NPK combinations were used. The field was thoroughly prepared and fertilizer was applied to each subplot according to sowing plan before sowing. The experiment was laid out in randomized complete block design with three replication. Each plot measured 4 x 1.8 m or 7.2 m$^2$ i.e. 4 rows, 4 meter long with spacing of 45 cm. Plant to plant distance was kept 10 cm, with a sowing depth of 2-3 cm. Sowing was done, using Kera method. Two irrigations were applied during the whole cropping season. Digging of the pods was started at maturity. The plants from each plot were labeled and kept separated. The pods were collected and yield data in kg/ha were recorded. Necessary agronomic and plant protection measures were adopted at appropriate intervals to raise a good crop. The seed yield and other relevant data on different varieties were collected as per standard procedure.

**Results and Discussion**

*1. Maturity and Plant Height (cm)*

Data on days to maturity and plant height is presented in table-1. Days to maturity revealed significant differences at (P≤ 0.05). It is evident from the data that T4 (75 : 60 : 60 N:$P_2O_5$ : $K_2O$ kg/acre) was late maturing with 182.3 days, while T7 (50 : 60 : 0) and T9 (00:00:00) was early in maturity with 178.0 days each. Plant height remained non-significant at (P≤ 0.05), however, maximum plant height of 37.8 cm was recorded for treatment No. T5, while minimum plant height of 30.3 cm was recorded for treatment No. T2. Variation in days to maturity may be attributed to application of N fertilizer. Excessive use of N fertilizer delays maturity, therefore delayed maturity in T4 might be due to high dose of N fertilizer. Haq and.Jakhro (1996).

***Table-1.***

*Days to Maturity and Plant Height (cm) as affected by various doses of NPK fertilizer.*

| **Treatments (kg/acre)** | | | | **Days to maturity** | **Plant height (cm)** |
|---|---|---|---|---|---|
| | **N** | **$P_2O_5$** | **$K_2O$** | | |
| T1 | 0 | 60 | 60 | 178.0 D | 36.7 |
| T2 | 25 | 60 | 60 | 178.0 D | **30.3** |
| T3 | 50 | 60 | 60 | 179.7 BC | 33.9 |
| T4 | 75 | 60 | 60 | **182.3 A** | 31.0 |
| T5 | 50 | 0 | 0 | 180.3 B | **37.8** |
| T6 | 50 | 75 | 60 | 178.7 CD | 36.0 |
| T7 | 50 | 60 | 0 | **178.0 D** | 34.0 |
| T8 | 50 | 60 | 75 | 179.3 BC | 37.3 |
| T9 | 0 | 0 | 0 | **178.0 D** | 32.3 |
| LSD value (P 0.05) | | | | 40.046 | N.S. |
| C.V. (%) | | | | 9.6 | 16.6 |

*2. Pods/Plant and Kernels/Pod*

Data on pods/plant and kernels/pod is presented in table-2. Pods per plant revealed significant differences at (P≤ 0.05). It is evident from the data that maximum pod/plant of 48.0 were recorded for T2 (25:60:60), while minimum pods/plant of 25.6 were recorded for T9 (check). Data on kernels/pod revealed non-significant differences at (P≤ 0.05), however, maximum kernels/pod of 1.7 were recorded for T2 (25:60:60) while minimum kernels/pod of 1.3 were recorded for T9 (check). These results are in agreement with Yakadri and Satyanaryana (1995) who studied the response of groundnut to varying, levels of N and P and suggested that 30 kg N and 60 kg $P_2O_5$ $ha^{-1}$ influenced the filled pods $plant^{-1}$, kernel/pod and100 kernel weight and shelling percent at Hyderabad.

*Table-2.*

*Pods/plant and Kernels/pod as affected by various doses of NPK fertilizer.*

| **Treatments (kg/acre)** | | | | **Pods/ plant** | **Kernel/ pod** |
|---|---|---|---|---|---|
| | **N** | **$P_2O_5$** | **$K_2O$** | | |
| T1 | 0 | 60 | 60 | 46.6 AB | 1.4 |
| T2 | 25 | 60 | 60 | **48.0 A** | 1.7 |
| T3 | 50 | 60 | 60 | 42.0 BC | 1.6 |
| T4 | 75 | 60 | 60 | 46.4 AB | 1.7 |
| T5 | 50 | 0 | 0 | 42.4 BC | 1.4 |
| T6 | 50 | 75 | 60 | 46.8 AB | 1.6 |
| T7 | 50 | 60 | 0 | 39.2 C | 1.7 |
| T8 | 50 | 60 | 75 | 47.0 AB | 1.7 |
| T9 | 0 | 0 | 0 | **25.6 D** | 1.3 |
| LSD value (P 0.05) | | | | 5.55 | N.S. |
| C.V. (%) | | | | 7.5 | 12.8 |

*3. 20 Pods Length and 100 Kernels Weight*

Data on 20 pods length and 100 kernels weight is presented in table-3. It is clear from the data that 20 pods length remained non significant, however, maximum 20 pod length of 66.5 cm was noted for T4 while minimum 20 pods length of 57.0 cm was noted for T9 (check). Data on 100 kernels weight showed significant differences at (P≤ 0.05). Maximum 100 kernel weight of 87.7 gm was recorded for T2 (25:60:60) while minimum 100 kernels weight of 75.3 gm was recorded for T9 (check). These results are in agreement with Mishra (1994) who reported that the highest dry pod yield of groundnut was obtained at 60 kg $P_2O_5$ $ha^{-1}$ and lowest under the control.

Similarly, highest plant height (cm), branches/plant, shelling (%), oil (%)and 100 kernel weight were under 60 kg $P_2O_5$ $ha^{-1}$, whereas lowest under the control for all the components.

*Table-3.*
*20 Pods length (cm) and 100 Kernels weight (gm) as affected by various doses of NPK fertilizer.*

| Treatments (kg/acre) | | | | 20 pod length (cm) | 100 kernal wt: (gm) |
|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | | |
| T1 | 0 | 60 | 60 | 64.0 | 84.6 AB |
| T2 | 25 | 60 | 60 | 64.8 | **87.7 A** |
| T3 | 50 | 60 | 60 | 63.8 | 78.5 BC |
| T4 | 75 | 60 | 60 | **66.5** | 83.5 ABC |
| T5 | 50 | 0 | 0 | 65.1 | 79.3 ABC |
| T6 | 50 | 75 | 60 | 63.6 | 82.8 ABC |
| T7 | 50 | 60 | 0 | 59.2 | 82.2 ABC |
| T8 | 50 | 60 | 75 | 60.0 | 82.0 ABC |
| T9 | 0 | 0 | 0 | **57.0** | **75.3 C** |
| LSD value (P 0.05) | | | | N.S. | 9.1 |
| C.V. (%) | | | | 10.3 | 4.9 |

*4. Plant Population and Pod Yield (per ha.)*
Data on plant population and pod yield is presented in table-4. Plant population remained non significant at 5% level of significance. Data on pod yield showed significant differences at 5% level of significance. It was observed that T2 (25:60:60 NPK kg/acre) had maximum pod yield of 2490 kg/ha, while minimum pod yield of 1850 kg/ha was recorded for T9 (check). These results are in agreement with Brike *et al*., (1994) concluded that pod yield increased with the application of N at 20 and 40 kg $ha^{-1}$ over the control. Similarly Mishra (1994) reported that the highest dry pod yield of groundnut was obtained at 60 kg $P_2O_5$ $ha^{-1}$ and lowest under the control.
*Table-4.*
*Plant Population/ha and Pod Yield (kg/ha) as affected by various doses of NPK fertilizer.*

| Treatments (kg/acre) | | | | P.P/ha | Pod yield kg/ha |
|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | | |
| T1 | 0 | 60 | 60 | 80,000 | 2009 BC |
| T2 | 25 | 60 | 60 | 73,000 | **2490 A** |
| T3 | 50 | 60 | 60 | 76,700 | 2222 ABC |
| T4 | 75 | 60 | 60 | 70,300 | 1914 C |
| T5 | 50 | 0 | 0 | 75,700 | 2134 BC |
| T6 | 50 | 75 | 60 | 79,300 | **2319 AB** |
| T7 | 50 | 60 | 0 | 76,000 | 2037 BC |
| T8 | 50 | 60 | 75 | 79,300 | **2296 AB** |
| T9 | 0 | 0 | 0 | 73,300 | **1850 C** |
| LSD value (P 0.05) | | | | N.S. | 336.7 |
| C.V. (%) | | | | 13.5 | 6.8 |

## CONCLUSION

The experiment on different doses of NPK fertilizers was conducted at the Agriculture Research Institute Mingora, Swat to evaluate the optimum and economical dose of fertilizer for groundnut cultivation in the area. Nine fertilizer treatments (including one control) with different NPK combinations were used. The field was thoroughly prepared and fertilizer was applied to each subplot according to sowing plan before sowing. The experiment was laid out in randomized complete block design with three replication. Necessary agronomic and plant protection measures were adopted at appropriate intervals to raise a good crop. Based on yield and yield components data, it was concluded that treatment T2 (25:60:60 $N:P_2O_5:K_2O$ kg/ha) gave the highest pod yield of 2490 kg/ha followed by treatment T6 (50:75:60 and T8 (50:60:75) with pod yield of 2319 and 2296 kg/ha, respectively, against the control T9 (00:00:00) which gave 1850 kg/ha. It is therefore suggested that these doses of NPK fertilizer should be recommended to the farmers in order to raise a healthy and good groundnut crop and ultimately get highest yields.

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