Research Note

EFFECT OF DIFFERENT LEVELS OF N, P AND K ON THE GROWTH AND YIELD OF CABBAGE

Muhammad Din, Muhammad Qasim and Maraj Alam

ABSTRACT

Effect of different doses of NPK fertilizers on cabbage growth and yield (cv. Golden Acre) was studied during 2005 under the agro-climatic conditions of Juglot, Gilgit, Northern Areas of Pakistan. NPK level of 120-90-60 kg per hectare significantly performed better with regard to head weight (1.05 kg/plant), head diameter (24.46 cm/plant) head length (24.66 cm/plant), marketable heads (13770/ha) and head yield (35170 kg/ha). Minimum values for these parameters were recorded in control where no fertilizer was applied.

KEYWORDS: Brassica oleracea, NPK fertilizers; agronomic characters, Pakistan.

INTRODUCTION

Cabbage (Brassica oleracea L.) is a heavy feeder, especially for nitrogen and potash. It is considered as a hard crop on the soil and there is an experimental evidence to substantiate this belief. The amount and type of fertilizer used for this crop vary in different parts of the country, depending on soil and climatic conditions. Heavy application of manure before planting eliminates the necessity for heavy nitrogen side-dressings and reduces amount of fertilizer that must be applied. Many experiments have shown that cabbage gives a good response to manure and most of earlier experiments indicate a superiority of manure over commercial fertilizers. Borisov et al. (2) studied that vegetable production increased by 54 percent in rotation with combination of fertilizers, manure and green manure. The greatest benefit of manure or soil-improvement crops for cabbage seems to be slowly availability of nitrogen which is utilized by cabbage efficiently throughout its growth. Even if a large amount of chemical nitrogen is applied at planting heavy losses from leaching result in nitrogen deficiency later in the season. It has been found that cabbage crop producing 50.84 tons per hectare consumed 10 kg N, 100 kg P₂O₅, 200 kg K₂O and 50 tons FYM per hectare, where N was split and applied as a top dressing 60 days after planting (8).

*Karakoram Agricultural Research Institute for Northern Areas, Gilgit (Pakistan).

J. Agnc. Res., 2007, 45(2)
Being a heavy feeder of nutrients, cabbage requires special attention for harvesting a good yield. The heads will not form unless adequate nitrogen is given. Morris (6) noted main response to N in increasing size of heads in cabbage while both P and K caused a slight increase in yield. Excessive nitrogen, on the other hand, may cause loose head formation and internal decay.

The average yield of cabbage produced in Northern Areas is far below than that produced in other parts of the country. It may be due to low and improper use of mineral fertilizer to the crop. Fertilizer use has made phenomenal progress in this country without an equal increase in crop yields unfortunately. It may be due to imbalanced use of fertilizer nutrients. At present N:P ratio in our country is 3.8:1, which should be 2:1 or 1.5:1. This highly imbalanced use is one of major reasons for stagnant yield levels in other crops as well. A judicious and balanced use of fertilizer can nevertheless bring about a substantial increase in crop productivity (1).

As no research work has so far been conducted on this aspect, present study was conducted to find out optimum dose of N, P and K for cabbage crop in Northern Areas.

MATERIALS AND METHODS

This study was conducted at Karakoram Agricultural Research Institute for Northern Areas, Pakistan during 2005. While preparing the field a soil samples upto 25 cm depth were obtained for chemical analysis. These samples were analyzed for soil texture, lime contents, organic matter, N, P, K and pH in the laboratory of National Agricultural Research Centre, Islamabad. The physico-chemical characteristics of experimental site are given below:-

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texture</td>
<td>Sandy loam</td>
</tr>
<tr>
<td>Lime content</td>
<td>6.30%</td>
</tr>
<tr>
<td>Organic matter</td>
<td>0.8%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.45%</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>140 mg/kg</td>
</tr>
<tr>
<td>K₂O</td>
<td>93 mg/kg</td>
</tr>
<tr>
<td>PH</td>
<td>7.5</td>
</tr>
</tbody>
</table>

The experiment was laid out in randomized complete block design with three replications and 11 treatments. The plot size was 15 m². The total area of trial

*J. Agric. Res.*, 2007, 45(2)*
unrolled leaves of five randomly selected plants in each treatment were counted and then average number of leaves per plant was calculated.

To determine head diameter per plant, five heads from each treatment were randomly selected and their circumferences were determined by measuring tape and diameter of heads were obtained with following formula.

\[ \text{Diameter} = \frac{\text{Circumference}}{3.14} \]

Five plants were randomly selected from each treatment for determining average head length per plant. Each head length was measured from lower portion to top portion of head and in each treatment all heads having, 1 kg or more weight, were considered as marketable and their number per treatment was converted to number of marketable heads per hectare. For determining head weight, five plants were randomly selected and their heads were weighed to calculate the average head weight per plant.

RESULTS AND DISCUSSION

No effect of different treatments was observed on the number of leaves per plant (Table). However, these results do not agree to those of Khokhar et al. (5). The data also revealed non-significant effect on leaf area. Maximum head diameter (24.40 cm/plant) obtained from fertilizer level of 120-90-60 kg while minimum (23.29 cm/plant) from control (no fertilizer). Maximum head diameter may be attributed to increased water content and accumulation of reserved substances in leaves which increased water content and accumulation of reserved substances in leaves which increased supply of N, P and K. Khokhar et al. (5) also observed that N, P and FYM increased the yield of marketable heads of cabbage and best yield was obtained at higher rates of N (168 kg/ha) and P₂O₅ (90 kg). Similar results were also recorded by Khadir et al. (4) who observed maximum head diameter in cabbage at maximum fertilizer level.

Table. Cabbage yield and its components as affected by various levels of N, P and K.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of leaves/plant</th>
<th>Head diameter (cm)</th>
<th>Head length/plant (cm)</th>
<th>Head weight/plant (kg)</th>
<th>No. of marketable heads/plot</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>19.44c</td>
<td>23.29d</td>
<td>19.44c</td>
<td>0.5517d</td>
<td>3556d</td>
<td>8390d</td>
</tr>
<tr>
<td>T₂</td>
<td>20.88bc</td>
<td>23.53cd</td>
<td>20.88bc</td>
<td>0.7339cd</td>
<td>4100d</td>
<td>24470cd</td>
</tr>
<tr>
<td>T₃</td>
<td>22.00abc</td>
<td>23.81cd</td>
<td>22.00abc</td>
<td>0.9109abc</td>
<td>7111cd</td>
<td>30830abc</td>
</tr>
<tr>
<td>T₄</td>
<td>22.33ab</td>
<td>23.45d</td>
<td>22.33ab</td>
<td>0.9477abc</td>
<td>9111bc</td>
<td>31030abc</td>
</tr>
<tr>
<td>T₅</td>
<td>21.89abc</td>
<td>23.78bcd</td>
<td>21.89abc</td>
<td>0.7559bcd</td>
<td>9333bc</td>
<td>25170bcd</td>
</tr>
<tr>
<td>T₆</td>
<td>24.55a</td>
<td>24.21ab</td>
<td>24.55a</td>
<td>0.7253cd</td>
<td>11110ab</td>
<td>24180cd</td>
</tr>
<tr>
<td>T₇</td>
<td>21.60ac</td>
<td>23.44cd</td>
<td>21.60ac</td>
<td>0.9553abc</td>
<td>9559abc</td>
<td>31600abc</td>
</tr>
<tr>
<td>T₈</td>
<td>24.46a</td>
<td>24.40a</td>
<td>24.45a</td>
<td>1.055a</td>
<td>13370a</td>
<td>35170a</td>
</tr>
<tr>
<td>T₉</td>
<td>22.55ab</td>
<td>23.84bcd</td>
<td>22.55ab</td>
<td>0.8177abc</td>
<td>8667bc</td>
<td>27260abc</td>
</tr>
<tr>
<td>T₁₀</td>
<td>23.27abc</td>
<td>24.00abc</td>
<td>23.22abc</td>
<td>0.9667abc</td>
<td>10800ab</td>
<td>32220ab</td>
</tr>
<tr>
<td>T₁₁</td>
<td>23.33ab</td>
<td>24.33ab</td>
<td>23.33ab</td>
<td>0.9993ab</td>
<td>11760ab</td>
<td>35370ab</td>
</tr>
</tbody>
</table>

J. Agric. Res., 2007, 45(2)
was 495 m². Row to row distance was kept as 60 cm and plant to plant 50 cm. NPK treatments detail is given below:

$\begin{align*}
T_1 & = \text{Control} \\
T_2 & = 0-60-60 \text{ kg/ha} \\
T_3 & = 60-60-60 \text{ kg/ha} \\
T_4 & = 120-60-60 \text{ kg/ha} \\
T_5 & = 180-60-60 \text{ kg/ha} \\
T_6 & = 120-0-60 \text{ kg/ha} \\
T_7 & = 120-30-60 \text{ kg/ha} \\
T_8 & = 120-90-60 \text{ kg/ha} \\
T_9 & = 120-90-0 \text{ kg/ha} \\
T_{10} & = 120-60-30 \text{ kg/ha} \\
T_{11} & = 120-60-90 \text{ kg/ha}
\end{align*}$

The seeds were obtained from Vegetable Section, National Agricultural Research Centre, Islamabad. Cabbage (cv. Golden Acre) seeds were sown in nursery beds on 18th June, 2005. During the preparation of nursery beds well-rotten FYM was added. The beds were raised 10 cm from the soil surface to provide good drainage for removal of surplus irrigation. The seeds were sown in 10 cm apart and covered with fine and well-rotten FYM. Beds were immediately irrigated with sprinkler and were covered with wheat straw. After three days seed germination started and completed after six days. Irrigation was given at three days interval with sprinkler. When seedlings reached to 3 cm height, thinning was done to get healthy and strong seedlings. Healthy seedlings of uniform size were selected and transplanted from nursery beds to the field on 15th July, 2005. Before transplantation nursery beds were irrigated so that seedlings could be easily taken out from beds without damaging the roots. After one-week of transplantation, dead seedlings (5%) were replaced by planting fresh seedlings to obtain uniform stand. Full dose of $P_2O_5$ (60 kg/ha) as single super phosphate and $K_2O$ (60 kg/ha) as sulphate of potash (SOP) with half dose of N (60 kg/ha) in the form of urea was applied at soil preparation through broadcast, while remaining N was applied 30 days after transplanting. After transplantation, experimental field was irrigated and second irrigation was applied three days after transplantation. After this, irrigation was given at 4-6 days interval upto crop harvest. First hoeing and weeding was done 20 days after transplantation and two more weedings were done at one month interval. When head formation started cabbage aphid (Aphis brassicae) appeared on the later part of cabbage and spray of Karate controlled it. Crop was harvested when heads attained the proper size. To determine number of leaves per plant
In case of head length maximum value (24.46 cm/plant) was recorded from fertilizer level (120-90-60 kg), while minimum (19.44 cm) from control treatment. Maximum head length may be attributed to maximum weight (1.05 kg) and diameter (24.66 cm) of cabbage plant.

The data (Table) further indicate that maximum number of marketable heads (13370) was recorded in T3 (120-90-60 kg NPK) while minimum (3556) in T1. Maximum number of marketable heads was due to optimal level of N and P with combination of K, which increased both fresh weight and marketable heads. Humadi and Abdul-Hadi (3) reported that maximum number of marketable heads were found at 240 kg N and 120 kg P2O5. Singh and Naik (9) observed maximum marketable heads at fertilizer level of 60 to 120 kg N and 30 to 90 kg P2O5 per hectare. Similar results were reported by others (5, 7).

In case of head yield 120-90-60 kg NPK produced maximum which was due to higher head weight (1.05 kg/plant), head diameter (24.46 cm), head length (24.66 cm) and number of marketable heads (13370) and vice versa (Table). Use of optimal NPK doses can contribute better and continuous supply of nutrients to plants during growth and development, which subsequently increase yield. More or less similar results were also observed by Tarita (10) and Khadir et al. (4).

CONCLUSION

It is concluded that application of NPK significantly increased cabbage yield and its components. Combined application of 120 kg N, 90 kg P2O5 and 60 kg K2O per hectare proved better for each yield parameter. N application higher than optimal dose had adverse effects on yield of cabbage. Increased doses of P2O5 and K2O performed better.

REFERENCES


J. Agric. Res., 2007, 45(2)


