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Effect of Different Levels of Nitrogen, Phosphorus and Potassium on the Growth and Yield of Cabbage

¹Razaullah Khan, ¹Sher Ahmed, ²Salimullah Khan, ¹Fayaz Ahmed, ¹Meer Zaman and ¹Bashir A. Khan
¹Karakoram Agriculture Research Institute for Northern Areas (KARINA), Pakistan
²University of Chakdara, Malakand, Pakistan

Abstract: A field experiment was conducted to evaluate the influence of N₂, P₂O₅ on the growth and marketable yield of cabbage. All three nutrients were given in five different combinations with or without FYM. Results showed that N₂, P₂O₅ and K₂O @ 160:90:60 kg ha⁻¹ alone with FYM @ 15-20 t ha⁻¹ gave the maximum total weight of 1641 g in T₅ followed of T₄ as 1459 g given N₂, P₂O₅, K₂O @ 120:90:0 kg ha⁻¹ with FYM @ 15-20 t ha⁻¹, whereas in the control treatment, no fertilizer it was found 1004. As far as weight of edible portion is concern it was significant amount all treatments, in T₅ it was found as 1099 g followed by T₄ as 929 g, the minimum weight of edible portion was obtained in control treatment, with no fertilizers as 597 g. Although, plant with maximum height was found in T₅, but it was found non-significant among all treatments. Data on the girth indicates that it was significant among all treatments. Maximum girth was obtained in T₅ as 41.69, followed as 39.46 in T₃. On the whole it was observed that application of N, P₂O₅ and K₂O @ 160:90:60 along with FYM @ 15-20 t ha⁻¹ gave the desirable results in term of growth and marketable yield of cabbage.

Key words: Fertilization, NPK, cabbage, growth, yield

Introduction

Cabbage (*Brassica oleracea*. L var Capitata) belongs to the to the family Cruciferae possibly originating in Europe (Central Europe) like Greece and Italy about 2000-2500 BC. It has been an important vegetable in USA and Europe till today But it introduction into the Indo-Pakistan subcontinent is somewhat recently. Botanically, Cabbage is a biennial crop being grown for its large edible and terminal buds. Most of the commercial varieties have more or less round heads, with slightly tighten, folded leaves.

Cabbage is known for its nutritional importance, it is rich in minerals and vitamins like A, B1, B2 and C. It is also known for its cooling effect. Being an appetizer, it aids digestion thereby help preventing constipation. Cabbage is a cool-season vegetable flourish well in cool moist climate it tolerates frost and extreme chilling. In plain areas of Pakistan cabbage is grown from October to January, while in hilly areas, it is grown as spring and early winter vegetable. Early crops are grown mostly on light soil while the late crops is grown on heavy soils which are most retentive of moisture and rich (Thompson and William, 1982). It has been found that a crop of cabbage producing 70 tons per hectare consumes 370 Kg N, 85 Kg P₂O₅ and 480 Kg K₂O from soil . It needs nitrogen in optimum amount, excessive amount of nitrogen may cause loose head formation and internal decay if nitrogen is not in adequate amount it would not form heads. The demand for phosphorus increases manifold during head formation stage. While potassium deficiency can result in marginal necrosis and retards head quality but it excess cause the head to open. The crop required high sulfur and it is sensitive to deficiency of Mg and B. Cabbage can be grown on wide range of soils, from clayey to sandy loam soils, however the latter on suit best. Soil pH is an important parameter in site selection for its successful germination and growth it should be grown on soil having pH less than 5.5 or higher than 6.5.

Northern Areas of Pakistan extends over 69120 Km² out of which 3416 Km² area is under agriculture, forest and the rest of 6704 Km² is mountains, alpine pasture, river and glaciers covered. The area is having Mediterranean climate with sever cold during winter and hot in summer (Whiteman, 1985; Whyte, 1968). In Northern areas the yield of cabbage is below the average. It may be due to the unbalance and injudicious use of fertilizers. At present the N: P ratio in our country is 3:8:1 which ideally should be 2:1 or 1:5:1. This highly use of imbalance fertilizer is two edges sword, being environmentally unsound and economically

unviable. The judicious and balance use of fertilizers ,can nevertheless brings about a substantial increase in crop productivity (Anonymous, 1995). No efforts have seriously been done in this direction, despite the fact that of N₂, P₂O₅ and K₂O in optimum amount increase the total marketable yield of cabbage (Sharma *et al.*, 1988; Khadir *et al.*, 1991; Sing and Naik, 1995).

Materials and Methods

The experiment was conducted at Karakoram Agriculture Research Institute for Northern Areas, Juglot (KARINA) some 50 Km South East of Gilgit during early spring 2001. The experiment was laid out in the randomized block design (RBD), consists of 5 treatments and 5 replication. The cabbage seeds were sown under plastic using plastic film technology (PFT), a project being supported by IUCN-Gilgit.

Since temperature drops less than 0 °C during winter, therefore plastic cover provides enough warm to make germination successful, young seedling were shifted to field in the March-April 2001. Line to line distance was kept as 45 cm while plant to plant distance was kept as 30 cm plot size was kept as 10 m². Farmyard manures were applied @15-20 t ha⁻¹ to all treatments except control treatment.

The treatments were control no NPK and FYM (T₁), T₂ as NPK all zero with FYM, T₃ as N@ 90 Kg ha⁻¹ with FYM. T₄ N@ 120 Kg ha⁻¹, P @ 90 Kg ha⁻¹ with FYM. and T₅ as N@ 160 Kg ha⁻¹ P @ 90 Kg ha⁻¹ and K@ 60 Kg ha⁻¹ with FYM.

Nitrogen was applied in the split doses, while phosphorus and potassium were applied in single doses well before transplantation. Ten plants were selected randomly in each plot.

Analysis for different parameters like total weight, weight of edible portion, both in grams, while girth and plant height were taken in cm. The attack of cabbage butterfly was notice, it lasts for two weeks.

All data were analyzed statistically using the Standard Analysis of Variance. Means were compared using the least significant difference (LSD)

Results and Discussion

Total weight (g): The results obtained on total weight showed (Table 1) that cabbage with maximum total weight was obtained in T₅ as 1641 g, followed by T₄ as 1459 g. The application of N₂, P₂O₅ and K₂O all three along with FYM increases the total marketable weight. These findings are in concurrent with the

Khan *et al.*: Fertilization, NPK, cabbage, growth, yield

Table 1: Effect of N, P and K on the total weight and weight of edible portion (g)

Treatments	Total weight (g)	Weight of edible portion
T ₁	1004c	597c
T ₂	1209bc	718bc
T ₃	1419abc	979ab
T ₄	1459ab	929a
T ₅	1641a	1099a

Table 2: Effect of N, P and K on the plant height and girth

Treatments	Plant height (cm)	Girth (cm)
T ₁	23.34	32.88b
T ₂	23.48	35.38ab
T ₃	24.57	39.46ab
T ₄	24.40	38.78ab
T ₅	24.85	41.69a

Means followed by different letter (s) within columns different significantly at $p < 0.05$

findings of Kang *et al.* (1989) and Silva (1994). Kang *et al.* (1989) reported that increase in the rate of N from 15-30 Kg ha⁻¹ to 45 Kg ha⁻¹ results in increase of marketable yield. Same response has been observed in this study.

Weight of edible portion (g): The maximum weight of edible portion (Table 1) was observed in T₅ as 1099. Followed by T₃ as 979, and T₄ as 929 respectively. Kang *et al.* (1989) reported that by keeping the P and K fixed, increase in the amount of N from 15-30 kg ha⁻¹ to 45 kg ha⁻¹ results in increase of marketable yield. Optimal doses of NPK can contribute better and continuous supply of nutrients to the plant during growth and development. At lower level of nutrients were least available, resulted in low yield.

Plant height (cm): The plant height (Table 2) indicated that it was not significantly affected by any of the treatment, It was however, observed that highest plants were seen in T₅, as 24.85 cm followed by T₄ as 24.40 cm.

Girth of the plant (cm): Data on the girth of cabbage (Table 2) indicates that there was found significant difference among all treatments. Maximum girth was found in T₅ as 41.69 cm followed by T₄ as 38.78 cm These results are in conformity with Mitra *et al.* (1990) who reported that nitrogen in combination with P and K increase the girth of the plant. Similar results were recorded by Khadir *et al.* (1991) who observed maximum head girth in cabbage with maximum fertilizer inputs.

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