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Effect of Various NPK Fertilizer Doses on the Growth, Seed Yield and Oil Content of Brassica

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Abstract: The field experiment was conducted to observe the effect of different fertilizer doses (0-0-0, 30-20-10, 60-40-20, 90-60-30, and 120-80-40 NPK Kg^{-ha} on growth, yield and oil content of Toria Selection (*Brassica compastrist* L.) brassica variety at Z.A. Bhutto Agricultural College, Dokri, Pakistan. Application of 120-80-40 and 90-60-30 NPK kg^{-ha} fertilizer doses equally showed efficiency of producing taller plants, more branches, increased number of siliqua, lengthy siliqua, bold seeds in siliqua, and heavier seed index, which in-turn increased seed yield and oil contentof the crop. Thus, it is recommended that Toria Selection brassica variety should be fertilized with 90-60-30 or 120-80-40 NPK kg^{-ha} for maximum yield and oil content.

Key Words: Brassica-NPK-Growth-Yield-Oil Content

Introduction

Despite increasing demand for edible oils in the country the local production has been stagnant which meets only about 25 % of the total requirement of the country. The shortage of edible oil in Pakistan started developing from 1997's, this was due to increase in consumption due to an increase in population. Cotton seed and rape seed mustard are the major domestic source of edible oil and occupies the second place. Part production from sesame and entire production from groundnut is consumed as raw with no oil extracted (Chaudhary *et al.*, 1988). To increase the present production level of oil seed crops, it is necessary to regulate proper improved package of technology. Among the various improved technology packages, balanced application of major nutrient elements like N and P together with introduction of new lines play vital role in the stability of edible oil in the country to solve domestic requirements, because our soils are deficient in N and P due to continuous growing of crops year after year. Nitrogen is the major nutrient element required by the plant in high quantity. The role of N in plant is to improve photosynthetic activity and provide lush green color due to chlorophyll. The scarcity of N results in poor vegetative growth which has direct effect on reduction of total seed yield. However, higher application of N causes delayed crop maturity which has subsequent effect on the crop. Phosphorus is a fascinating plant nutrient. It is involved in a wide range of plant processes from permitting cell division to the development of a good root system and ensured timely uniform ripening of the crop. It is needed mostly by young fast growing tissues and performs a number of functions related to growth, development, photosynthesis, and utilization of carbohydrates. It is a constituent of ADP and ATP which are most important functions in life process (Tandon, 1987). A crop which has access to sufficient P benefits in many ways. It gets hard start right from the seedling stage, produces deeper and proliferous root which enable it to feed on a bigger soil volume for water and nutrients. Phosphorus in growing plants is quite mobile. When the deficiency of phosphorus starts to develop in a plant, the absorbed phosphorus migrates from older to the young plant parts. Symptoms of phosphorus deficiency therefore appear first on older leaves, gradually bluish-green to radish color develops which can lead to stunted growth and death of the plant. If, the phosphors deficiency appears, then soil and plant tests should be done and fertilizer must be added by rectifying and short comings in fertilizer practices particularly while aiming for high yield and profits (Tandon, 1987). Although our soils are not deficient in available potassium as compared to nitrogen and phosphorus, however, there is need to apply potassium fertilizer to readily available to plant as the role potassium fertilizer is so vital and needed to be applied. Potassium gives resistance to plant against lodging, insect pest attack, and helps in maturity. Looking the importance of these nutrients in plant and soil, an attempt was made to assess their effect on growth, seed yield, and oil content of brassica.

Materials and Methods

The field research was conducted at Z.A. Bhutto Agricultural College Daokri, Sindh, Pakistan to evaluate the effect of various NPK fertilizer doses on the growth and yield of Brassica variety Toria Selection (*Brassica compastris L.*). The experiment was laid-down in RCBD, replicated three times. The area was prepared by three dry plowings each followed by clod crushing and leveling to eridicate the weeds and uniform distribution of irrigation. The seeds were drilled in rows 45cm apart to test the NPK fertilizer doses i.e 30-20-10, 60-40-20, 90-60-30-, 120-80-40 Kg^{-ha} and control (no fertilizer application)NPK fertilizer was applied as Urea, Single Super Phosphate, and Sulphate of Potash. The full dose of P and K with 1/3 of N was applied at the time of final harrowing, while rest of N was splited into three equal doses and top-dressed at first irrigation, flowering, and seed formation period. To maintain area and crop growth all the cultural practices were adopted when every necessary.

Results and Discussion

The experimental results for plant growth showed that plots treated with 90-60-30 or 120-80-40 NPK Kg^{-ha} displayed taller plants, followed by 60-40-20 and 30-20-10 NPK kg-ha. However, dwarf plants were observed in untreated control. These results are in agreement with the findings of Kandil (1983) and Modal Gaffar (1983), who reported that higher applications of NP improved

Table 1: Mean Plant height, Branches/plant, siliqua/plant, length of siliqua, seeds/siliqua, seed weight/plant, seed index, and seed yield of Toria Selection brassica variety as affected by NPK fertilizers

Fertilizer NPK Kg^{-ha}	Plant Height (cm)	Branches/ Plant	Siliqua/ Plant	Length of Siliqua (cm)	Seeds/ Siliqua	Seed Weight/ Plant (g)	Seed Index (1000 Seed Weight) (g)	Seed Yield Kg^{-ha}
Control	68.20	6.35	310.30	4.20	5.00	8.24	414.00	690
30-20-10	89.95	10.15	690.45	6.35	7.15	21.45	582.00	970
60-40-20	95.43	12.00	740.25	7.00	8.12	25.45	620.40	1034
90-60-30	115.00	13.20	985.45	8.50	9.35	27.20	720.00	1200
120-80-40	117.15	13.80	990.15	8.75	9.50	28.00	750.00	1250
Mean	97.15	11.10	743.32	6.96	7.82	22.00	617.28	1129

plant height than plots receiving no fertilizers. Branches, number of siliqua, seed weight per plant, and seed index equally recorded maximum values with the incorporation of 90-60-30 to 120-80-40 NPK Kg^{-ha} levels. Similar results for branches per plant were exhibited by Scarisbrick *et al.,* 1980, and Ali and Rehman, 1986, number of siliqua per plant (Mudhalkar and Ablawat, 1981), length of siliqua (Qayyum *et al.,* 1991), number of seeds per siliqua and seed index (Rind, 1998), seed weight per plant (Kalhoro, 1995), and seed yield (Panwar and Bhardwaj, 1976 and Bhan and Amar Singh, 1976). The oil content of the mustard crop also responded and showed efficiency for gaining maximum oil content with the application of higher fertilizer doses. The results also agree with the findings of Ganga Saran *et al.,* (1981), and Gupta and Saini (1982), who reported that oil yield depends on seed yield and was significantly influenced by nitrogen application. Increased rate of fertilizers also increases the seed yield and oil content (Joarder, 1983, Nordestgaard *et al,* 1984, and Rind, 1998), because deficit or no fertilizer applications turns the plants yellow and stunted (Augustinassen *et al.,* 1983). Nitrogen fixation in the soil increases along with the increase in N fertilizer level and a significant effect on P uptake is observed by plants (Nie and Liu, 1982). Nutrient combinations also offers higher benefit cost ratio (around 1:1.5) which indicates their economic viability. The yields are also more responsive to N and S than P and K nutrients. NPK and S uptake by plants as well as grains reflects a complimentary relationship between these nutrients applied to the crop (Jahan *et al.,* 1992). The rape require and consumes adequate nitrogen under favorable conditions. Soil conditions govern the amount of N which should be applied to ensure satisfactory deep root penetration and hardy top growth. Application of N 14 days after the start of visible growth is economically beneficial compared to flowering stage (Cramer, 1984). On the basis of results it was concluded and recommended that variety Toria Selection when fertilized with 120-80-40 or 90-60-30 KNPK Kg^{-ha} superseded over other combinations for obtaining higher yield and oil content.

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