



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(11): 1659-1662
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www.thepharmajournal.com
Received: 13-08-2023
Accepted: 22-09-2023

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Response of different organic manures and fertilizers on growth and yield of Knol Khol (*Brassica oleracea* var. *gongylode* L.)

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Abstract

The study titled "Response of Different Organic Manures and Fertilizers on Growth and Yield of Knol Khol (*Brassica oleracea* var. *gongylode* L.)" was carried out during the Rabi season of the 2021-2022 year at the Instructional Farm of the Department of Horticulture, AKS University in Satna, Madhya Pradesh. The research employed a Randomized Block Design featuring 12 distinct treatments viz., T₁-Control, T₂-100% Farm Yard Manure @15t/ha, T₃-100% Vermi Compost @10t/ha, T₄-100% Poultry Manure @5t/ha, T₅-100% RDF = NPK (100:60:100), T₆-75% RDF + Farm Yard Manure @15t/ha, T₇-75% RDF + Vermi Compost @10t/ha, T₈-75% RDF + Poultry Manure @5t/ha, T₉-50% RDF + Farm Yard Manure @15t/ha, T₁₀-50% RDF + Vermi Compost @10t/ha, T₁₁-50% RDF + Poultry Manure @5t/ha, T₁₂-50% Farm Yard Manure + Vermi Compost + Poultry Manure. Each treatment was replicated three times and the results indicated that the application of 75% RDF + Vermi Compost at 10t/ha had a significantly positive impact on the growth and yield parameters of Knol Khol.

Keywords: Knol Khol, FYM, vermicompost, poultry manure, knob yield

Introduction

Knol-khol (*Brassica oleracea* var. *Gongylode* L.) belongs to the family "Cruciferae" and the genus "Brassica." It is a winter season crop. It is also known as kohlrabi. The edible part of the stem, which is a swollen bulb, is called a knob. This results from the thickening of the stem tissue. The knob can be green or purple in color and is generally round to flat in shape, developing above the ground. It is an excellent vegetable when used at an early stage before it becomes tough and fibrous. This vegetable is also called the "German turnip" and "turnip cabbage" in other parts of the world. In India, it goes by different names in different states: Navilkosu (Kannada), Nulkol (Telugu), Seema Mulangi (Malayalam), Navalkole (Marathi), Ganth Gobi (Hindi), and Olkopi (Bengali).

The edible part of the knol-khol is the swollen stem, which stores food materials, especially starch and sugar. When consumed in its raw form, it provides a sweet taste with a mild aroma. The knob fully develops above the ground part of the plant, which is edible and delicate in taste and texture.

It is a well-established fact that plant growth and yield are greatly influenced by a wide range of nutrients (Kamal *et al.*, 2013)^[7]. Nitrogen is the main component of proteins, nucleic acids, chlorophyll, and pigments. Optimal nitrogen supply favors the transformation of carbohydrates into proteins and promotes the formation of protoplasm as the plant becomes more succulent. Adequate nitrogen supply is associated with vigorous vegetative growth and a more efficient use of available inputs.

Phosphorus is an essential component of nucleic acids, phospholipids, and many enzymes. It is also essential for the transfer of energy within the plant system and has beneficial effects on early root development, plant growth, and yield quality. Most of the soils in the state of Rajasthan are deficient in phosphorus and organic matter. About 93–99 percent of the total phosphorus in the soil is insoluble and not directly available to plants. Potassium also plays an important role in crop productivity. It provides increased vigor and disease resistance to plants and acts as an activator for many enzymes like pyruvate kinase and cytoplasmic enzymes. Potassium is responsible for a wide range of effects on the metabolic events of the plant system and is involved in the movement of carbohydrates and soluble nitrogen compounds.

There is also evidence of direct involvement of potassium in photosynthesis through its association with chloroplasts, where it is highly concentrated in leaf tissue. The activity of soil organisms is essential to ensure sufficient nutrient supply to the plant. If microorganisms find suitable conditions for their growth, they can efficiently dissolve nutrients and make them available to the plants.

Materials and Methods

The experiment entitled "Response of Different Organic Manures and Fertilizers on Growth and Yield of Knol Khol (*Brassica oleracea* var. *gongylode* L.)" was conducted during the Rabi season of the year 2021-2022 on the Instructional farm of the Department of Horticulture, AKS University, Satna (M.P.). The experiment was laid out in a Randomized Block Design comprising 12 treatments, namely, T₁- Control, T₂ -100% Farm Yard Manure @15t/ha, T₃ - 100% Vermi Compost @10t/ha, T₄ - 100% Poultry Manure @5t/ha, T₅ - 100% RDF = NPK (100:60:100), T₆ -75% RDF + Farm Yard Manure @15t/ha, T₇ -75% RDF + Vermi Compost @10t/ha, T₈ -75% RDF + Poultry Manure @5t/ha, T₉ -50% RDF + Farm Yard Manure @15t/ha, T₁₀ -50% RDF + Vermi Compost @10t/ha, T₁₁ -50% RDF + Poultry Manure @5t/ha, T₁₂ -50% Farm Yard Manure + Vermi Compost + Poultry Manure, each replicated three times. Treatments were randomly arranged in each replication, divided into twelve plots. The seeds were sown on 26th October 2021, germination started, and transplanted on 29th November 2021. The recording of observations was done 15 days after transplanting, and subsequent readings were recorded after every 15-day interval. The crop was harvested on 17th February 2022. Raised nursery beds of 3.0 x 1.0 m were prepared thoroughly. Then the seeds were sown on 26th November 2021 during the Rabi season. The nursery beds were maintained systematically for 31 days until the seedlings were ready for transplanting. In order to maintain a uniform crop stand in each plot, the dead seedlings were replaced by new ones up to 5 DAT. This gap filling continued for 10 days after transplanting. The first light irrigation was given soon after sowing to ensure proper germination, and subsequent irrigations were given at intervals of 10–20 days. Flood irrigation was given once a week during the entire period of crop growth. Thinning of the plants was done to maintain proper spacing. The experimental plot was kept free from weeds by regular hand weeding. Fifteen days after germination, light irrigation was given to the field. Weeding and hoeing of the field were conducted. After top-dressing the remaining amount of fertilizer, earthing up was done to promote proper development of roots and provide proper soil aeration. Irrigation was done immediately after the operation.

Results and Discussion

Data mentioned in Table 1 clearly revealed that the optimum levels of nutrients significantly improved plant height at all the growth stages. The maximum plant height at 30, 45, and 60 days after transplanting (DAT) was recorded for T₇ with 75% RDF + Vermi Compost at 10 t/ha, measuring 10.61 cm, 18.54 cm, and 27.03 cm, respectively. The minimum plant height was observed in treatment T₁ (Control) with measurements of 3.30 cm, 6.70 cm, and 15.12 cm at the respective time points. The highest number of leaves per plant at 30, 45, and 60 DAT was recorded for T₇ with 75% RDF + Vermi Compost at 10 t/ha, with values of 4.86, 14.32, and

23.15, respectively, while the lowest number of leaves per plant was observed in treatment T₁ (Control) with values of 3.04, 6.13, and 11.29, respectively.

The stem diameter (cm) at 45 DAT showed significant variation among the treatments. The maximum stem diameter (1.96 cm) was recorded for T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (1.72 cm) with 75% RDF + Poultry Manure at 5 t/ha. The minimum stem diameter (1.04 cm) was recorded in treatment T₁ (Control). The maximum leaf area per plant (737.18 cm²) was recorded for treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (733.82 cm²) with 75% RDF + Poultry Manure at 5 t/ha, while the minimum leaf area per plant (417.31 cm²) was observed in treatment T₁ (Control).

The minimum days required for 50 percent knob initiation (35.07) were recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (35.44) with 75% RDF + Poultry Manure at 5 t/ha. These results are consistent with Davood *et al.* (2010) [5], Gautam (2012) [6], Kamal *et al.* (2013) [7], Raj *et al.* (2014) [12], Zhang *et al.* (2015) [17], Babych *et al.* (2017) [11], Choudhary *et al.* (2018) [4], Singh *et al.* (2020) [13], and Choudhary *et al.* (2022) [3] in Knol Khol. The maximum days required for 50 percent knob initiation (45.62) were recorded in treatment T₁ (Control).

The minimum days required for 100 percent knob initiation (43.75) during the flowering period were recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (44.92) with 75% RDF + Poultry Manure at 5 t/ha. The maximum days required for 100 percent knob initiation (56.97) were observed in treatment T₁ (Control). The minimum days required for knob maturity (56.04) during the harvesting period were recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (57.28) with 75% RDF + Poultry Manure at 5 t/ha. The maximum days required for knob maturity (71.16) during harvesting were recorded in treatment T₁ (Control).

The maximum diameter of knob (7.52 cm) was recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (7.37 cm) with 75% RDF + Poultry Manure at 5 t/ha, while the minimum knob diameter (4.34 cm) was observed in treatment T₁ (Control). The maximum fresh weight of knob (133.17 g) during harvesting was recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (131.19 g) with 75% RDF + Poultry Manure at 5 t/ha. The minimum fresh weight of knob (60.52 g) during harvesting was recorded in treatment T₁ (Control). Similar results were supported by the findings of Mahaveer *et al.* (2010) [9], Upadhyaya *et al.* (2012) [16], Shukla *et al.* (2013) [14], Parmar *et al.* (2016) [11], Bhoopendra *et al.* (2017) [2], Ola *et al.* (2019) [10], Kaur *et al.* (2021) [13], and Sreekanth *et al.* (2022) [15].

The maximum yield per plot (4.794 kg) was recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (4.722 kg) with 75% RDF + Poultry Manure at 5 t/ha. The minimum yield per plot (1.098 kg) was recorded in treatment T₁ (Control). The maximum knob yield (27.07 tonnes/hectare) was recorded in treatment T₇ with 75% RDF + Vermi Compost at 10 t/ha, followed by T₈ (26.68 tonnes/hectare) with 75% RDF + Poultry Manure at 5 t/ha. The minimum knob yield (9.73 tonnes/hectare) was recorded in treatment T₁ (Control). From the results, it can be concluded that in the study, T₇ with 75% RDF + Vermi Compost at 10 t/ha significantly improved the plant growth and yield parameters of Knol Khol.

Table 1: Effect of Different Organic Manures and Fertilizers on Growth and Yield of Knol Khol

Treatments	Plant height (cm)	Number of leaves per plant	Diameter of Stem (cm) 45 DAT	Leaf area per plant (cm ²)	Days required for 50 percent knob initiation	Days required for 100 percent knob initiation	Days required for knob maturity	Diameter of knob (cm)	Fresh Weight of knob (g)	Yield (kg/plot)	Yield (tones/hectare)
T ₁	15.12	11.29	1.04	417.31	45.62	56.97	71.16	4.34	30.52	1.098	9.73
T ₂	17.86	13.32	1.17	534.72	42.30	53.02	64.22	5.58	110.07	3.962	23.15
T ₃	18.94	15.47	1.21	643.61	39.83	49.57	62.14	6.04	117.89	4.244	24.41
T ₄	18.42	14.65	1.19	637.28	40.57	51.48	63.37	5.86	114.25	4.113	24.39
T ₅	23.91	20.13	1.47	713.50	37.12	44.31	57.97	6.95	127.04	4.573	25.75
T ₆	25.45	20.29	1.53	729.25	36.60	43.54	57.65	7.10	129.76	4.671	25.92
T ₇	27.03	23.15	1.96	737.18	35.07	43.75	56.04	7.52	133.17	4.794	27.07
T ₈	26.63	21.72	1.72	733.82	35.44	44.92	57.28	7.37	131.19	4.722	26.68
T ₉	19.55	16.52	1.23	648.43	38.41	48.09	60.90	6.21	119.58	4.304	24.64
T ₁₀	21.50	18.76	1.35	672.01	37.75	46.15	58.64	6.73	123.54	4.447	24.97
T ₁₁	20.67	18.15	1.28	663.36	38.01	47.23	59.59	6.56	121.03	4.357	24.78
T ₁₂	22.76	19.01	1.40	695.14	37.35	45.86	58.13	6.81	124.07	4.466	25.43
S.Ed(±)	0.71	0.37	0.33	2.52	0.31	0.09	0.35	0.28	0.21	0.05	0.02
CD at 5%	1.42	0.76	0.68	5.05	0.63	0.20	0.71	0.56	0.42	0.11	0.04

Summary and Conclusion

A field experiment was conducted at the Agriculture farm of AKS University, Satna, during rabi season 2021-2022, to study the Impact of NPK and Organic Manure on Growth and Yield of Knol Khol (*Brassica oleracea var. gongylode* L).

Chapter one is introductory, which describes the importance of Knol Khol. In spite of its various uses its cultivation. Is decreasing day by day both in acreage and yield as well which surely will incur serious bad effects on economic condition of country.

Chapter two assimilate the previous works within the framework of this study which are helpful in interpretation of results obtained during the statistical analysis.

Chapter three deals the materials and methods used in this study. It includes experimental site, nature of soil of the experimental area, experimental treatments, layout of the experiment, field preparation, irrigation and intercultural operations, plant protection and observations under study. The experiment was set up using a randomized block design with three replications.

Chapter four deals with findings of the present study on the Response of different organic manures and fertilizers on growth and yield of Knol Khol (*Brassica oleracea var. gongylode* L.).

The maximum plant height at 30, 45 and 60 days after transplanting (DAT) was recorded due to T₇ with 75% RDF + Vermi Compost @ 10t/ha, (10.61, 18.54 and 27.03 cm respectively) and minimum plant height was recorded from the treatment T₁ with Control (3.30, 6.70 and 15.12 cm, respectively). The highest number of leaves per plant at 30, 45 and 60 days after transplanting (DAT) was recorded from T₇ with 75% RDF + Vermi Compost @10t/ha, (4.86, 14.32 and 23.15 respectively) and lowest number of leaves per plant was recorded from the treatment T₁ with Control (3.04, 6.13 and 11.29 respectively).

The diameter of stem (cm) at 45 DAT was found to be significant among the treatments. The Maximum diameter of stem (1.96 cm) was recorded in T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (1.72 cm) 75% RDF + Poultry Manure @5t/ha. Minimum diameter of stem (1.04 cm) was recorded in T₁ with Control.

Maximum leaf area per plant (737.18 cm²) was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha,

followed by T₈ as (733.82 cm²) 75% RDF + Poultry Manure @ 5t/ha. Minimum leaf area per plant (417.31cm²) was recorded in the treatment T₁ with Control.

Minimum days required for 50 percent knob initiation (35.07) was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (35.44) 75% RDF + Poultry Manure @5t/ha. Maximum days required for 50 percent knob initiation (45.62) was recorded in the treatment T₁ with Control.

Minimum days required for 100 percent knob initiation (43.75) for duration of flowering was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (44.92) 75% RDF + Poultry Manure @5t/ha. Maximum days required for 100 percent knob initiation (56.97) was recorded in the treatment T₁ with Control.

Minimum days required for knob maturity (56.04) for duration of harvesting was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (57.28) 75% RDF + Poultry Manure @5t/ha. Maximum days required for knob maturity (71.16) for duration of harvesting was recorded in the treatment T₁ with Control.

Maximum diameter of knob (7.52 cm) was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (7.37cm) 75% RDF + Poultry Manure @ 5t/ha. Minimum number of diameter of knob (4.34cm) was recorded in the treatment T₁ with Control.

Maximum fresh weight of knob (133.17 g) for duration of harvesting was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (131.19 g) 75% RDF + Poultry Manure @5t/ha. Minimum fresh weight of knob (60.52 g) for duration of harvesting was recorded in the treatment T₁ with Control.

Maximum yield per plot (4.794 kg) was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (4.722 kg) 75% RDF + Poultry Manure @5t/ha. Minimum yield per plot (1.098 kg) was recorded in the treatment T₁ with Control.

Maximum knob yield (27.07 tones/hectare) was recorded in the treatment T₇ with 75% RDF + Vermi Compost @10t/ha, followed by T₈ as (26.68 tones/hectare) 75% RDF + Poultry Manure @ 5t/ha. Minimum knob yield (9.73 tones/hectare) was recorded in the treatment T₁ with Control.

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