

Effect of varieties and spacing on growth, yield and quality of knolkhol (*Brassica oleracea* var. *gongylodes* L.)

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ABSTRACT

The field experiment was conducted at Horticulture Research Farm-I, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.), during rabi season of 2018-19 and 2019-20 to study the effect of varieties and spacing on growth, yield and quality of knolkhol (*Brassica oleracea* var. *gongylodes* L.). Four varieties and four spacings were evaluated in factorial randomized block design with three replications. The results revealed that the maximum plant height (29.7 cm), number of leaves (18.8), leaf length (24.5 cm), leaf width (26.4 cm) and plant spread (29.4 cm) were noted in variety White Vienna. The stem girth, days to knob initiation and knob harvest were not affected non-significant with varieties. The highest values of weight of knob (222.3 g) and yield (145.1 q ha⁻¹) were noticed in White Vienna. In general, lowest values of growth and yield attributes were noted under Pusa Virat. In general, lowest values of growth and yield attributes were noted under Pusa virat. The maximum plant height (31.2 cm), number of leaves (18.8), leaf length (25.2 cm), leaf width (26.4 cm), plant spread (30.9 cm) and knob weight (229.9 g) were recorded in spacing 60 x 45 cm whereas, the maximum yield (209.49 q ha⁻¹) was recorded in 30 x 30 cm spacing.

Keywords: Growth, knolkhol, spacing, quality, varieties, yield

INTRODUCTION

Knolkhol (*Brassica oleracea* var. *gongylodes* L.) is a rabi season crop under cole group and belongs to Brassicaceae family. Knolkhol has a bulb-like swollen edible portion called knob. The stem's fleshy turnip-like expansion develops completely above ground. The knob is harvested for human use as a raw or cooked vegetable, while young leaves are also utilised in some areas (Chadha, 2009). Kohlrabi taste feels like broccoli. It contains sulforaphane, a cancer-fighting compound. All components of the knolkhol plant have been reported to have enormous therapeutic powers. Asthma, cancer, high cholesterol, heart disorders, indigestion, muscle and nerve functioning, colon cancer, skin problems and weight loss are among the medicinal characteristics of the crop. In the growth and development of a crop, varieties are important. Only a few cultivars of knolkhol, such as Pusa Virat, White Vienna, Early White Vienna and Palam Tender Knob were developed for the cold winters of North India. Maintaining an appropriate plant population per unit area is essential for knolkhol better growth and higher production. Crop spacing can be adjusted according to climate, soil fertility and cultivar

suitability for a specific region. When the spacing was wider, the plant was more vigorous in terms of leaf size, which might be attributed to reduced competition for light, nutrients and moisture as compared to closer spacing Bairwa *et al.* (2017). So, in the present study efforts have been made to understand the impact of varieties and spacing on growth, yield and quality of knolkhol under Lucknow conditions.

MATERIALS AND METHODS

A field experiment was carried out at Babasaheb Bhimrao Ambedkar University, Lucknow, (U.P.), during rabi season of 2018-19 and 2019-20. The experimental site is situated at 80°92' East longitude and 26°76' North latitude and 123 meter above MSL (Mean Sea Level). The climate of Lucknow is characterized by sub-tropical with hot, dry summer and cool winters. The soil of experimental field is sandy loam and slightly alkaline in nature with soil pH 8.2. Seedlings of 30 days old were transplanted on November 2nd, 2018 and November 5th, 2019. In a factorial randomized design with three replications, four varieties: Pusa Virat, White Vienna, Early White Vienna and Palam Tender Knob with four spacings: 30 x 30 cm, 45 x 30 cm, 45 x 45 cm and 60 x 45 cm were evaluated.

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The application of recommended dose of fertilizer (180: 120: 100 kg ha⁻¹ NPK) through urea, diammonium phosphate and muriate of potash. Appropriate management practices were adopted. Randomly five plants were selected in each plot and data were recorded on the plant height, leaves per plant, leaf length, leaf width, plant spread, stem girth, days to knob initiation and knob harvest, weight of knob, volume of knob and yield. The total soluble solids (^oBrix) were determined by using hand refractometer and vitamin C by titration against 2,6 dichlorophenolindophenol dye (A.O.A.C., 1995). The data of both years were pooled and analysed statistically as per methods advocated by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Effect of varieties on growth parameters

The data on pooled mean basis (Table 1) revealed that the tallest plant (29.7 cm) was

recorded in White Vienna followed by Early White Vienna (29.3 cm) while, the shortest plant (27.3 cm) was found in Pusa Virat. The variation observed in different varieties may be due to genetic nature of the cultivars. These findings are in close conformity with the results of El-Bassiony *et al.* (2014) in knolkhol. The maximum leaves per plant (18.8) was noticed in White Vienna followed by Palam Tender Knob (18.1) and minimum leaves (17.1) in Pusa Virat. The variation in number of leaves per plant might be due to prevailing climatic conditions and genetic makeup of different cultivars (Yadav *et al.* 2013). The maximum length of leaf (24.5 cm), width of leaf (26.4 cm) and plant spread (29.9 cm) were noticed in White Vienna whereas, the minimum values (21.7 cm, 22.9 cm and 28.4 cm, respectively) were observed in Pusa Virat. These results are in close conformity with the findings of Bhangre *et al.* (2011) in broccoli. The stem girth, days to knob initiation and knob harvest differed non-significant among all varieties under this study.

Table 1: Effect of varieties and spacing on growth parameters of knolkhol (mean of 2 years)

Treatments	Plant height (cm)	Leaves per plant	Length of leaf (cm)	Width of leaf (cm)	Plant spread (cm)	Stem girth (cm)	Days to knob initiation	Days to knob harvest
Varieties								
Pusa Virat	27.4	17.1	21.8	22.9	28.4	11.4	36.8	63.0
White Vienna	29.8	18.9	24.6	26.4	29.7	10.9	34.8	64.3
Early White Vienna	29.3	17.5	23.9	25.5	29.6	11.2	36.5	63.9
Palam Tender Knob	28.8	18.1	24.1	26.2	29.4	11.3	37.5	63.8
SEm±	0.18	0.16	0.19	0.25	0.19	0.16	0.91	0.76
CD (P=0.05)	0.51	0.45	0.54	0.70	0.53	NS	NS	NS
Spacing (cm)								
30 x 30	27.2	17.1	22.6	24.5	27.9	11.0	36.4	62.9
45 x 30	28.1	17.5	23.2	24.6	28.4	11.2	34.1	63.3
45 x 45	28.7	18.2	23.4	25.6	29.8	11.2	37.0	63.8
60 x 45	31.2	18.8	25.2	26.4	30.9	11.4	38.0	64.9
SEm±	0.18	0.16	0.19	0.25	0.19	0.16	0.91	0.76
CD (P=0.05)	0.51	0.45	0.54	0.70	0.53	NS	NS	NS

Effect of spacing on growth parameters

The data (Table 1) revealed that the maximum plant height (31.2cm) and leaves per plant (18.8) were recorded in spacing 60 x 45 cm followed by 45 x 45 cm. However, the minimum plant height (27.2 cm) and number of leaves (17.1) were observed in 30 x 30 cm. The variation may be due to more sunlight and nutrients with wider spacing. Similar results were advocated by Kumar *et al.* (2021) in sprouting

broccoli. The maximum length of leaf (25.2cm), width of leaf (26.4 cm) and plant spread (30.9 cm) were obtained in spacing 60 x 45 cm while, minimum values (22.6 cm, 24.46 cm and 27.9 cm, respectively) were recorded in 30 x 30 cm spacing. Plants with wider spacing received more sunlight and nutrients due to fewer plants that might enhance vegetative growth of plant (Moniruzzaman, 2011). The stem girth, days to knob initiation and knob harvest were not affected non-significantly with spacings.

Effect of varieties on yield attributes and yield

A perusal of data (Table 2) revealed that maximum knob weight (221.1 g) was noticed in White Vienna followed by Early White Vienna (212.8 g) and minimum (192.2 g) in Pusa Virat. The variation in weight of knob under different cultivars may be attributed to their genetic architecture. The maximum volume of knob (113.7 cc) was obtained in Palam Tender Knob, which was found to be significantly superior as compared to other treatments but statistically at par with Early White Vienna. The minimum (102.5 cc) volume of knob was obtained in Pusa Virat. Similar results were reported by Silatar *et al.* (2018) in knolkhol. The maximum knob yield (145.1 q ha⁻¹) was noticed in White Vienna followed by Early White Vienna (140.5 q ha⁻¹) and minimum (126.5 q ha⁻¹) in Pusa Virat. Higher growth and yield attributes under variety White Vienna ultimately resulted in higher knob yield.

Similar findings were reported by Iqbal *et al.* (2010) in knolkhol.

Effect of spacing on yield attributes and yield

The maximum weight of knob (229.9 g) was obtained in spacing 60 x 45 cm followed by 45 x 45 cm (212.9 g) and minimum (191.8 g) in spacing 30 x 30 cm. This led to luxurious vegetative growth and maximum weight of knob (Kaur *et al.* 2021). The maximum volume of knob (114.3cc) was recorded in spacing 60 x 45 cm while, minimum (103.7 cc) in 30 x 30 cm spacing. The maximum knob yield (209.5 qha⁻¹) was noticed 30 x 30 cm spacing and minimum (85 qha⁻¹) was observed in spacing 60 x 45 cm. By increasing the spacing, total yield of knolkhol decreased significantly due to a greater number of plants accommodated in a given area. These results are in close conformity with the findings of Thirupal *et al.* (2014) in broccoli.

Table 2: Effect of varieties and spacing on yield and quality parameters of knolkhol (mean of 2 years)

Treatments	Weight of knob (g)	Volume of knob (cc)	Yield (q ha ⁻¹)	Total soluble solids (°Brix)	Vitamin-C (mg/100g)
Varieties					
Pusa Virat	192.2	101.9	126.5	2.9	33.9
White Vienna	222.3	109.5	145.1	2.9	37.3
Early White Vienna	210.7	110.3	140.5	3.2	36.4
PalamTender Knob	210.6	112.9	138.4	3.5	36.7
SEm±	3.42	1.39	2.40	0.07	0.17
CD(P=0.05)	9.68	3.92	6.79	0.21	0.48
Spacing (cm)					
30 x 30	191.8	103.7	209.5	3.3	35.7
45 x 30	201.2	105.9	151.3	3.2	36.7
45 x 45	212.9	110.1	104.6	3.1	36.1
60 x 45	229.9	115.0	85.0	3.1	35.9
SEm±	3.42	1.39	2.40	0.07	0.17
CD(P=0.05)	9.68	3.92	6.79	0.21	0.48

Quality parameters

Data Table 2 revealed that different varieties had significantly effect on quality parameters of knolkhol and maximum TSS (3.54 °Brix) was found in Palam Tender Knob followed by Early White Vienna (3.21 °Brix). However, minimum TSS (2.99 °Brix) was noted in Pusa Virat. The maximum vitamin C (37.26 mg/100g) was noticed in White Vienna followed by Early White Vienna whereas, minimum (33.9 mg/100g) in Pusa Virat. It could be attributed to the genetic

makeup of these varieties. These results have parity with Zaki *et al.* (2015) in Broccoli. The maximum TSS (3.27 °Brix) was obtained in 30 x 30 cm spacing and minimum (3.13 °Brix) in spacing 30 x 30 cm. The maximum vitamin C (36.76 mg/100g) was found in spacing 45 x 30 cm and minimum in (35.7 mg/100g) in 30 x 30 cm. These results are in close conformity with the findings of Kumar and Rawat (2002) in cabbage.

Based on two-year field experiment, it can be concluded that the effect of varieties and spacing on the growth, yield and quality of

knolkhol was significant. The White Vienna with spacing of 60 x 45 cm proved to be most effective in increasing the plant height, number of leaves, length of leaf, width of leaf and plant spread and weight of knob of knolkhol. The

maximum yield was obtained in White Vienna with spacing 30 x 30 cm. Hence, White Vienna with spacing of 30 x 30 cm may be recommended for cultivation in Lucknow conditions of Uttar Pradesh.

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