Research Article

Effect of different plant spacing on the production of turnip (*Brassica rapa* L.) under agro-climatic conditions of Swabi (Pakistan)

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Abstract

The experiment entitled “Effect of different plant spacing on the production of Turnip (*Brassica rapa* L.) under agro-climatic conditions of Swabi” was conducted at Agriculture research farm, The University of Swabi during 2013-14. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications and three treatments of planting spaces. Data were recorded for the qualitative and quantitative traits. Variation was observed for all the characters studied. The results showed that there was a significant effect of plant spacing on root weight (gm.), number of leaves while non-significant result was obtained on seedling leaf colour, seedling pubescence, mortality rate and germination percentage. Maximum green seedling leaf colour (3.40), sparse seedling pubescence (3.80), mortality rate (20%), root weight (1448.3g), number of leaves (35.66) was noted in plant spacing 2.5 ft while the minimum light green seedling leaf colour (3.0), root weight (951.7g), number of leaves (25.32), germination (77.4%) was recorded with plant to plant distance of 1.5 ft. Based on the above outcomes it is recommended that spacing of 2.5 ft should be kept for best growth and maximum fresh production of turnip.

Keywords: Fresh production; Number of leaves; Spacing; Turnip; Vegetative parameters

Introduction

Turnip (*Brassica rapa* L.) belongs to family Cruciferae [1] and native of Northern Asia and extensively grown in Europe [2]. It is one of the most important dicotyledonous, cross pollinated and cool season vegetable crop grown both for its enlarged roots and for the foliage. The roots are either eaten raw or cooked; Turnip is relative of Cabbage, Cauliflower, Rape and Kale etc.

Both its enlarged roots and foliage are used as salad, cooked and pickled. The young tops are very rich in minerals, vitamin A and C. They also contain about 92.3% water, 0.8% protein, 0.2% fats, 6% carbohydrates and 0.7% ash [3]. According to [4] the crude protein ratio increased with late sowing while root length, root diameter, root yield, leaf yield, dry matter yields, ADF, NDF ratios of root and leaf

decreased. Increasing level of salinity caused a marked reduction in germination percentage, fresh and dry biomass of the seedlings of all cultivars of both species. Both species displayed highly significant intra-specific variation in seed germination and seedling growth at higher levels of salt [5]. Sharma & Kanavjia [6] planted radish (cv. Pusa Reshmi) at spacing of 60 x 30, 60 x 45 and 60. Amongst them spacing of 60 cm gave the highest 1000 seed weight, germination percentage, seedling length, vigour index, seed N protein content and seed yield (29.39g/Plant). Rehman Ali [7] said that high yield of seed in turnip was obtained with the seedlings grown on 10th December at 20 cm plant spacing in Peshawar area of Khyber Pakhtunkhwa, Pakistan.

The total cultivated area of turnip in Pakistan according to 2012-2013 statistics is 15,766 hectares with total production of 2,76,471 tons with average yield per hectare is 17.5359 tonnes. Whereas in Khyber Pakhtunkhwa province of Pakistan the cultivated area for Turnip constitutes 2997 ha with production of 42,082 tonnes having average per hectare yield of 14.0413 tonnes [8]. Turnip is among the vegetables whose yield per hectare is very low in Pakistan as compared to other countries. Turnip is important cool weather vegetable crop of Pakistan and especially in Khyber Pakhtunkhwa. It is grown mainly for root throughout the country. Despite of its wide cultivation the average seed yield is rather low. Limited attention has been paid towards scientific method of good quality root and seed production. Keeping the above mentioned facts in mind; the effect of plant spacing's was tested as the productivity factor with the following objectives:

1. Evaluate the performance of turnip in Agro-climatic condition of Swabi.
2. To determine the effect of various plant spacing's on the yield of turnip.

Materials and methods

An experiment on the "Effect of plant spacing on the production of Turnip

(*Brassica rapa* L.)" under agro-climatic conditions of Swabi was conducted at the Agriculture Farm, The University of Swabi, during the winter season of 2013-14. The variety Purple top was chosen for the study because it is one of the most popular varieties in the market for its excellent taste. The seeds were obtained from the local market of Swabi. Timely intercultural practices were done to keep the plot free from weeds. Seeds were sown in the month of November and all the agronomic practices were carried out uniformly. The experiment was laid out in Randomized Complete Block Design (RCBD) with one factor that is plant spacing. 1.5', 2' and 2.5' distances were kept between plant to plant. Row to row spacing between plants was 40cm held constant throughout the experiment. The total area of experiment was 124 square meter. The subplot size was 2 × 2 meter while total number of treatments was replicated thrice. There were 3 main plots further divided into three subplots for each replication which were three in number. The total number of plants grown in each replication was 88. After germination thinning was carried out to keep the uniform plant distance.

The following parameters were studied on Turnip.

Qualitative characters

Seedling leaf colour

(1) White Green (2) Yellow green (3) Light green (4) Green (5) Dark green (6) Purple green.

Seedling pubescence

(0) Glabrous (1) Very sparse, few on leaf margins only (3) Sparse (5) Intermediate (7) Abundant.

Quantitative characters

Germination percentage

Germination percentage was calculated from the total number of plants germinated in the field.

Number of leaves plant⁻¹

Number of leaves was counted from 15 representative plants from each sub plot.

Root weight plant⁻¹ [g]

A single root weight was taken with the help of digital balance.

Mortality percentage

Mortality percentage was calculated from the total number of plant failed in the experiment.

Data analysis

Statistix (8.1) software was used for statistical analysis of means obtained during the experiment.

Results and discussion

An experiment “Effect of different plant spacing on the production of Turnip (*Brassica rapa* L.) under agro-climatic conditions of Swabi” was conducted at Agriculture farm the University of Swabi, during the winter season in 2013-2014. The data was collected on seedling leaf colour, seedling pubescence, mortality rate, root weight¹ plant (gm.), number of leaves and germination percentage. Data noted on the means of stated parameters are shown in (Table 1).

Seedling leaf colour

The mean values concerning seedling leaf colour is given in table 1 which displayed that plant to plant spacing had non-significantly affected the seedling leaf colour of turnip. The green seedling leaf colour (3.40) was observed in plants having plant to plant distance of 2 and 2.5ft while light green seedling leaf colour (3.0) was recorded in plants with plant to plant spacing of 1.5 ft. According to [9] nitrogen application results in dark green colour in turnips. Nitrogen application in our experiment had shown an improved effect on the green colouring of turnip leaves regarding 2 and 2.5 feet.

Seedling pubescence

Mean results related to seedling pubescence are presented in table 1. The table 1 indicated a non-significant result for seedling pubescence regarding different plant to plant spacing of turnip. The sparse seedling pubescence (3.80) was recorded in plants planted 2.5 ft apart while the sparse seedling pubescence (3.13) observed in plants having plant to plant spacing 2 ft. In

our study seedling of turnip had pubescent leaves. According to [10] *Brassica villosa* plantgroup with less density of trichomes had more damaged by flea beetles as compared to the group with higher density of trichomes which means that plant hairs act as a physical barrier by preventing the flea beetles. The attack of flea beetles observed in our experiment was noticed to be very rare. Suo *et al.* [11] that trichomes are beneficial for the provision of temperature control, regulation of water, freezing tolerance, protection against pathogens and ultraviolet radiation (UV). This is why the turnips in our experiment had an excellent flavour.

Mortality rate (%)

The mean value about mortality percentage is given in table 1 which showed that plant to plant spacing had non-significant effect on mortality rate of turnip. The maximum mortality rate (20) was recorded in plants having plant to plant distance of 2.5 ft while minimum mortality rate (5) was observed in plants with plant to plant spacing of 2 ft. The possible reason can be the saline soil as reported by [12]. They explained that percent germination of seedlings showed significant decrease with increasing salinity in sugar beet and cabbage. The notable area of Pakistan is affected by the salinity of soil and water logging as reported by [13]. Shallhevet [14] described that salinity effect on most of the crops is higher at the seedling stage.

Root weight plant¹ (g)

Data concerning weight of root per plant were subjected to statistical analysis and results obtained regarding mean values are given in table 1 which demonstrated significant results for different plant to plant spacing. The maximum root weight (1448.3g) was observed in plant to plant spacing of 2.5 ft. while the minimum root weight (951.7 g) recorded on spacing of plant to plant 1.5 ft. Similar results were obtained in onion by [15] and in radish by [16]. They reported that yield is increased with increasing the planting distances.

Number of leaves

Mean data in table 1 revealed that plant to plant spacing significantly affected the number of leaves of turnip crop. The highest number of leaves (35.66) was recorded in plants having plant to plant distance of 2.5 ft while the least number of leaves (25.32) was observed in plants having plant to plant spacing 1.5 ft. Our findings were in agreement with the findings obtained by [6] in radish crop. They observed that increasing plant spacing results in increasing number of leaves.

Germination percentage (%)

Data concerning germination of turnip regarding plant to plant spacing is presented in mean (Table 1). Statistical analysis of the data revealed a non-significant effect of plant to plant spacing on germination of

turnip. However, maximum germination (80%) was documented on plant sown at spacing of 2 ft and minimum germination (77.4%) was recorded plant sown at spacing of 1.5 ft. Seed priming technique has been used to germinate the seedlings [17, 18]. Emergence of purple top turnip variety is not affected by the application of seed priming as mentioned by [19]. The possible reason can be the saline soil as reported by [20] that a major portion of Pakistani soils are affected by soil salinity and water logging. [21] said that out of salt affected soils of NWFP (now Khyber Pakhtunkhwa) 63500 acres are porous saline-sodic soils, the proportion of saline sodic soils, surface/patchy salinity and sodicity are 2200 and 12800 acres respectively.

Table 1. Effect of plant spacing on the different parameters recorded in turnip crop

Plant to Plant distance (ft)	Seedling leaf colour	Seedling pubescence	Mortality rate	Root weight (gm.)	Number of leaves	Germination percentage
1.5	3.47	3.73	12.00	951.7 c	25.32 c	77.33
2.0	3.40	3.13	5.00	1013.3 b	29 b	94.00
2.5	3.40	3.80	20.00	1448.3 a	35.66 a	80.00
LSD ($P \leq 0.05$)	NS	NS	NS	2.78	2.74	NS

Conclusions

It is concluded from the current experiment that turnip crop with plant to plant spacing of 2.5 ft gave maximum green seedling leaf colour (3.40) sparse seedling pubescence (3.80), mortality rate (20), root weight (1448.3g), number of leaves (35.66), and germination (80%). While, the minimum light green seedling leaf colour (3.0), root weight (951.7g), number of leaves (25.32), germination (77.4%) was recorded in plants with plant to plant distance of 1.5 ft.

Recommendations

Based on the result of the experiment it is recommended that turnip crop should be sown at distance of 2.5 feet for better quality and higher fresh production.

Authors' contributions

Conceived and designed the experiments: I Jan & Q Ali, Performed the experiments: Q Ali, F Sattar, M Sayam & W Sajjad, Analyzed the data: SU Rahman & M Ali,

Contributed materials/ analysis/ tools: I Jan & M Faheem, Wrote the paper: Q Ali & SU Rahman

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