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Effect of Sowing Time on Growth Behaviour of Beet Root in Sub-mountainous Climatic Conditions

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Abstract: The study was conducted to assess the optimum sowing time for beet root production under Soan Valley conditions. Mean values of the data depicted that different sowing dates had a profound effect on growth behaviour and quality of produce in beet root crop. Early sowing (10, 20 and 30th September) reduced seed germination period 6.00-10.50 days as compared with delayed sowing (20 and 30th October) with 13.22 and 15.70 days, respectively. Flower initiation and seed ripening period was delayed in the plants resulted from early sowing. Poor quality beet ball having maximum weight (228.00 g) was produced from early sown crop. Delayed sowing resulted into acceptable ball weight (164.50-184.00 g) with deep red colour, smooth and round ball shape. Optimum sowing time for fresh beet ball production is from 15 to 30th October. The results indicated that the crop may be sown during last week of September and 1st week of October for seed production.

Key words: Beet Root, optimum sowing time, ball weight, quality produce, sub-mountainous tract

Introduction

Beet root (Beta vulgaris) belongs to Chenopodiaceae family. This is grown for salad and extraction of sugar from roots. The ball is usually round and small with thin red-brown skin and notably sweet flavour. Red beet root has the peculiarity of bleeding a crimson dye called Betanin, if its skin is pierced. It is usually cooked, backed, steemed or boiled whole with some of greens left intact. Even when sliced after cooking it has tendency to stain other ingredients, an effect which is sought for soups and salads. It is mostly a crop of temperate region where cool weather and high humidity are available. Its performance is better in long days having low night temperature. Soan Valley is a hilly pocket of district Khushab having 2500 to 4000 ft altitude with a temperature range (-1 to 41°C). Land holdings are small with limited water resources in the area. Beet root may be added in cropping pattern of the area as off season crop when grown in late summer. This project was investigated with the view to assess optimum sowing time for off season crop of beet root.

Different researchers have worked for its acclimatization all over the world and observed that it can be grown successfully year around in various localities and climatic conditions if sowing time is adjusted according to climatic conditions and market requirement. Rehman and Ali (2000) studied the effect of sowing time on Turnip crop and reported that sowing time significantly delayed blooming up to 94.13 days in crop sown during December as compared to 72.33 days for the crop sown in January. Sharma (1997) concluded that temperate types of Beet Root are sown from the middle of September to February. The tropical varieties are generally sown from early August to end of October. They bolt early if sown later. Mauryal *et al.* (1990) studied the effect of seed sowing dates on growth, yield and quality of radish and reported that early sowing results in late blooming and increased yield. Singh and Yadav (1989) reported that early sowing resulted into reduction of germination period and yield as compared with late sowing in peas. Habib-ur-Rahaman (1987) reported that early sowing results in well developed peas plants, which are vulnerable to plant damage by frost during winter. Fordonski and Gronowicz (1986) concluded from field trials that delay in sowing reduced plant height and yield per plant in peas. Hessayon (1985) observed that performance of beet is better in long days with low night temprature and seed sown during summer bolts early and affect the ball quality negatively. Thompson and Kelly (1982) stated that when beet plants are subjected to relatively low temprature of 40 to 50°F for 15 days, seeding is less as compared with beets exposed for 30 days to same temperature. Lorenz (1947) reported that beets planted in May had poor or fair colour, throughout summer months until October, when colour was classed as good.

Materials and Methods

The studies were conducted at Horticultural Research Station Naushera (Soan Vallay) district Khuashab, Pakistan during the year 2000 and 2001. Seed of Detroit cv of beet root was sown on ridges, 45 cm apart according to the treatments. Manual thinning was done when plant height was 15 cm and plant to plant distance was maintained as 20 cm. NPK was applied to the crop as 40, 20 and 20 Kg acre^{-1}, respectively. All phosphorus and potash was incorporated at the time of soil bed preparation. Half of nitrogen was applied with first

irrigation after completion of germination while the rest of nitrogen was applied after thinning while the cultural practices were kept the same for all treatments. Germination time was calculated by counting days from sowing date to first visible germinated plant. Average plant height was calculated on the basis of twenty plants from each treatment by random selection. It was measured by meter rod from ground level to central growing tip of the plant (cm). Flowering time was assessed by counting the days from sowing date to first flower bloom. Seed ripening period was assessed by counting days from first bloom to seed ripening when 50% pods dried. Average ball weight was enumerated by weighing 20 balls from each treatment randomly selected. The data regarding weight of ball and colour of ball were recorded 50 days after sowing the crop. The ball colour was assessed by comparison with standard horticultural colour chart after slicing the ball with a sharp knife.

Results and Discussion

Days required for seed germination: Beet seeds sown on 10 and 20th September, took minimum period of 6.25 and 6.00 days for seed germination. While crop sown on 20 and 30th October took maximum period for seed germination as 13.22 and 15.72 days, respectively during the study period. Results proved that a disparity of 10 days among sowing dates did not have a sound effect on seed germination time while further delay of more 10 days had a profound effect with a reciprocal delay in seed germination (Table 1). A gradual delay in sowing results in to a reciprocal increase in seed germination period, which is a result of lowering down of temprature. These results are in accordance with those of Singh and Yadav (1989), Hessayon (1985) and Sharma (1997).

Average plant height (cm): Data procured from the study depicted that maximum plant height (20.35 cm) was recorded in the plants raised from the seeds sown on 10th September while a gradual decrease in plant height was enumerated for those which were sown later (Table 1). Minimum height (15.13 cm) was recorded for the beet root plants which resulted from the seeds sown on 30th September during each year. A negative correlation among sowing dates and plant height is visible from results of the trial. This may be due to longer growth period experienced by plants resulted from beet seeds sown earlier(10, 20th September and 1st October). Taller

Table 1: Effect of sowing time on seed germination and plant height of beet root production

Sowing time	Days required for germination			Average plant height (cm) at maturity		
	2000	2001	Mean	2000	2001	Mean
10th September	06.15	06.35	06.25c	15.10	15.16	20.35a
20th September	05.92	06.08	06.00c	15.45	15.85	19.13b
30th September	10.42	10.58	10.50b	15.44	15.22	18.73b
10th October	10.15	10.85	10.50b	18.69	18.77	15.65c
20th October	12.78	13.22	13.00ab	19.12	19.14	15.48c
30th October	15.80	15.70	15.75a	20.33	20.37	15.13c
LSD			02.985			01.158

Table 2: Effect of sowing time on flower initiation and seed ripening of beet root

Sowing time	Flower initiation (Days)			Seed ripening period (Days)		
	2000	2001	Mean	2000	2001	Mean
10th September	107.45	108.15	107.80a	25.72	25.78	25.75c
20th September	95.48	95.52	95.50b	25.78	26.22	26.00c
30th September	83.60	84.40	84.00c	26.10	29,90	26.50c
10th October	73.72	73.78	73.75d	29.65	29.85	29.75b
20th October	68.72	68.78	68.75e	30.47	30.53	30.50b
30th October	67.73	67.77	67.75e	35.49	35.51	35.50a
LSD			3.035			1.965

Mean followed by same letter (s) in column do not differ significantly using LSD test at 5%

Table 3: Effect of sowing time on average weight of ball and its colour quality in beet root

Sowing time	Average ball weight (g) 2000	2001	Mean	Ball colour/appearance
10th September	226.50	229.50	228.00a	White streaks and cracked ball
20th September	219.55	220.05	219.80ab	White streaks and cracked ball
30th September	200.10	200.05	200.30abc	White streaks and small crackes on ball
10th October	195.00	195.60	195.30bcd	Very light white streaks and no cracks
20th October	164.20	164.80	184.00d	No white streak and crackes
30th October	183.90	184.10	164.50cd	Deep red colour and fine ball
LSD			31.79	

Means followed by same letter(s) in column do not differ significantly using LSD test at 5%

plants resulted into hardier and splited beet balls. These results are corroborated to the findings of Rahman (1987) and Fordonski (1986).

Flower initiation (days): A critical analysis of results (Table 2) for the trial envisaged proved that maximum time period (107.8 days) was recorded for flower initiation in beet root where seeds were sown on 10th September. Almost all the treatments had statistically significant differences among treatment means except those of 20 and 30th October, which are statistically at par with each other. Minimum time period (67.75 days) was noted for flower initiation in beet root crop when sown on 30th October. The results depicted that sowing time and flower initiation period were negatively correlated. Seeds sown earlier took more time period for flower initiation while it was earlier for the late sown crop of beet root. The findings are in line with the results of Mauryal *et al.* (1990); Rehman and Ali (2000).

Seed ripening period: A thorough study of the data (Table 2) for the said character proved that minimum time period (25.75 days) was recorded in early sown crop (10th October). Seed ripening period was found maximum (35.5 days) for beet root crop when seeds were sown on 30th October. Delay of 10.25 days was noted in late sown seeds (30th October). It may be attributed to lowering down of temprature during growth period. These results are supported by the investigations of Hessayon (1985); Thompsom and Kelly (1982).

Average ball weight (g): A perusal of the data (Table 3) on average ball weight of beet root depicted that it was maximum (228.00 g) for crop raised from seeds sown on 10th September. A gradual decrease in ball weight was noted with a regular delay of sowing time, which proved a negative correlation of ball weight and sowing date. Minimum ball weight (164.5 g) was produced by the crop which was sown on 30th October. Decrease in ball weight resulted by delay in sowing of seed is due to short growing period and vegetative growth of late sown crop. These results are in line with the findings of Hessayon (1985) and Mauryal *et al.* (1990).

Ball colour/appearance: Visual observation recorded (Table 3) for the colour and appearance of the produce/beet root ball varied among different treatments, when they were compared with standard horticultural colour chart. Observation recorded proved the excellence for colour of produce from late sown crop (30th October). It was concluded that best quality produce (ball) of beet root is achieved from the crop sown on 30th October. It specifies the particular sowing time of beet root crop for good quality beet balls. The deduced results are corroborated by the findings of Lorenz (1947).

Perusal of the observations recorded on quality features certified the reality that beet root is a crop of cool and humid areas and qualitative characters are positively affected with lowering down of temperature. Last week of October is standardized as the best sowing time for beet ball production and second fortnight of the September is best sowing time of beet root for seed production in Soan Valley climatic conditions.

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