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Date of Sowing and Genotype Interaction Effect on the Bulb Yield of Transplanted Onion (*Allium cepa* L.)

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Abstract: The effect of three planting dates viz. 1st, 15th and 31st Oct. 1998 and five varieties viz. Afghan white, Swat-1, Swat local, NARC-91 and Cross-bow (U.K. Source) were studied to establish the appropriate planting dates for various varieties and to select the best for higher yield of onion bulb for Malakand Division. The results indicated that planting on 1st Oct. had significant ($p<0.05$) effect on onion bulb production (79.71), number of leaves per plant (7.83), single bulb weight (55.63 g), fresh yield per hectare (79.58 tons). While maximum number of bulbs per kg (55.87) were found at planting on 31st Oct. Among the varieties, Afghan white had more neck height (8.52 cm) and single bulb weight (44.66 g), While Swat-1 showed significantly higher population percentage (84.60), fresh yield (12.72 t ha^{-1}) and similarly NARC-91 was also significantly higher number of leaves per plant (7.27). In interaction, Swat-1 planted on 1st Oct. showed highly significant effect on yield per hectare (101.67 tons).

Key words: Dates of sowing, varieties, interaction, yield *Allium cepa* L.

Introduction

Cultivar performance and date of planting play an important role in the selection of genotypes for yield improvement and adaptation to a particular environmental condition. Vegetables are short duration and are greatly affected by environmental conditions. Therefore, the effect of time of planting is usually more prominent. Onion, a commercial crop of the area (Malakand Division), is highly sensitive to temperature and photo-period. Difference in yield is caused by different planting times of the year (Verma *et al.*, 1971; Joshi and Phogat, 1975).

Pandy *et al.* (1992) reported that greatest neck thickness (0.65 cm), highest TSS (17.74%) and yield (209.25 q ha^{-1}) were obtained in 1st June sowing. Ramtohul and Owadally (1980) reported that maximum bulb production and best sowing time for Local Red was the first fortnight of March and maximum yield was given by Oct. sowing. Tropicana F1 was the best of the imported cvs. and Gizeh was the least promising.

Tomar *et al.* (1989) reported that highest bulb yield (448.57 q ha^{-1}) was obtained with earliest sowing as compared with 193.43 and 110.99 q ha^{-1} bulb yield in sowing on 15th Dec. and 15th Jan., respectively.

Khokhar *et al.* (1990) reported that highest mature bulb yield (31.4 t ha^{-1}) was obtained from Jaune Espagnol (bulb weight 441.5 g), followed by Jaune de Hatif and Texas Early Grano. Attar *et al.* (1991) found that later planting resulted in a decrease in the number of leaves, gross yield and net yield. Maximum number of leaves and yield were obtained with Poona Red and Nasik Red. Mingochi and Mpanda (1992) reported that significant difference among entries for bulb weight (127-218 g) and highest yield in being NIZ 1003 (29 t ha^{-1}) followed by Texas Yellow Grano (28.3 t ha^{-1}) was observed. In the later sowing date, bulb quality and overall mean yield was five times lower than in the earlier trial.

Orlowski and Rekowska (1992) showed that in all cultivars the earliest sowing date gave the highest yield with the other dates giving lower but similar results. With the earlier sowing date Wolska gave the highest average yield of 35.02 t ha^{-1}. Pakyurek *et al.* (1994) evaluated that autumn sowing produced higher yields than spring sowing. The cultivars SG 936, Ben Shemen, Akgun 12 and Corum produced the highest yields while there is no effect of row spacing on yield.

Materials and Methods

The study was conducted at Agriculture Research Station North Mingora, Swat during winter season 1998-99. Onion varieties (Afghan white, Swat-1, Swat local, NARC-91 and Cross-bow U.K source) were studied for growth and yield under the climatic conditions of Mingora, Swat. The experiment was designed in randomized complete block design with 12 treatments. Seed of these varieties were sown in well-prepared 15 cm raised beds on three different dates. Sowing was done from 1st to 31st Oct. with 15 days interval. Plot size was kept at 2 x 2 m^2. Transplantation of seedling was done from 1st to 31st Dec. 1998 with 15 days interval, using row to row and plant to plant spacing 20 and 6 cm respectively. During the course of the research work, onion fresh yield was studied with respect to varieties, date of planting and their interaction.

Results concerning population percentage, number of leaves per plant, number of bulbs per kg, single bulb weight, neck height, fresh yield (t ha^{-1}) were recorded and analysed statistically using LSD for means comparison.

Results and Discussion

Population percentage: Significant difference on population percentage was observed in sowing dates and varieties while non significant difference was found in interaction between dates of planting and varieties (Table 1). Sowing at the 1st Oct. showed maximum percentage (79.71) followed by 15th October sowing (74.20 %) and minimum (65.99 %) at 31st Oct., 1998. Swat-1 took highest percentage (84.60) as compared to 49.36 % of Cross-bow. The higher percentage was 87.36 of Swat-1 planting at 1st Oct. and the lower percentage was 29.52 of Cross-bow sowing at 31st Oct., 1998. It was also observed that population percentage was more (84.60 %) in Swat-1 and less (49.36 %) in Cross-bow. This result may be due to the response of different cultivars to different temperature level prevailing in the area. These results are in agreement with the reports of Wojtaszek and kmeicik (1978), who reported that early sowing increased the percentage of bulbs suitable for picking.

Number of leaves per plant: Statistical analysis revealed that the planting dates, varieties and their interaction has significant effect on the number of leaves per plant (Table 2). The effect of sowing dates on the number of leaves was significantly maximum (7.83) for planting at 1st Oct. and minimum (6.00) at the 31st Oct. sowing. Significantly large number of leaves per plant (7.27) was found in NARC-91 and lower (5.84) in Cross-bow. The effect of interaction between the sowing dates and varieties was also significant which was higher (8.40) for NARC-91 at 1st Oct. planting and lower (5.20) for Cross-bow at 15th Oct. planting. These results agreed with the results of Singh and Singh (1975), they reported that early sowing favored leaf, root and bulb growth and gave the highest yield. Similarly, the small number of leaves at later planting dates greatly confirmed with the results of Attar *et al.* (1991), they reported that later planting resulted in a decrease in the number of leaves, gross yield and net yield. Comparing the means of different varieties, affecting the number

Table 1: Population percentage in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	74.28	74.76	58.57	69.20b
Swat-I	87.63	81.90	84.28	84.60a
Swat-local	86.66	81.90	76.66	81.74a
NARC-91	82.85	81.42	80.95	81.74a
Cross-bow	67.14	51.42	29.52	49.36c
Means	79.71a	74.28ab	65.99b	

LSD value ($P<0.05$) for sowing dates = 8.844 and varieties = 11.42

Table 2: Number of leaves per plant in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	7.33bc	6.80cd	6.00def	6.71a
Swat-I	8.60a	6.73cd	5.73ef	7.02a
Swat-local	8.20ab	6.87cd	5.67ef	6.91a
NARC-91	8.40a	6.53cde	6.87cd	7.27a
Cross-bow	6.60cde	5.20f	5.73ef	5.84b
Means	7.83a	6.43b	6.00b	

LSD value ($P<0.05$) for sowing dates = 0.4336, varieties = 0.5597 and interactions = 0.9695

Table 3: Neck height (cm) in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	10.43a	8.57b	6.57cd	8.52a
Swat-I	7.10c	5.53def	4.67fg	5.77b
Swat-local	6.03cde	5.77def	4.73fg	5.51b
NARC-91	7.13c	4.30g	4.77fg	5.40b
Cross-bow	6.67cd	5.17efg	5.30efg	5.71b
Means	7.47a	5.87b	5.21c	

LSD value ($P<0.05$) for sowing dates = 0.5090, varieties = 0.6571, interaction = 1.138

of leaves per plant showed that NARC-91 had greater number of leaves per plant (7.27) and smaller number (5.84) was found in Cross-bow (Table 2). The difference may be due to the genes populations in specific variety. While the effect of interaction between the planting dates and varieties was also significant which was higher (8.60) of Swat-1 at 1st Oct. planting and lower (5.20) for Cross-bow at 15th Oct. planting. Also comparing the interaction between date of planting and varieties, maximum (8.60) number of leaves were found in Swat-1 at 1st Oct. planting and minimum (5.20) in Cross-bow at 15th Oct. planting. It may be due to the reason that different cultivars had differential response to temperature during vegetative stage.

Neck height: Both planting dates and varieties significantly ($P<0.05$) affect the neck height (Table 3). Maximum neck height (7.47 cm) was found at 1st Oct. planting. While minimum (5.21 cm) in 31st Oct. planting. There results, for certain extent, agreed with the results of Pandey *et al.* (1992), who reported that greatest neck thickness (0.65 cm) with 1st June sowing instead of 30th June, 15th July or 30th July. Also comparing the means (Table 3) for varieties, it was evident that Afghan white gave the greatest (8.52 cm) neck height while NARC-91 gave the lowest (5.40 cm) neck height. This difference may be due to the difference in genetic make up of the cultivars. While the interaction revealed that maximum (10.43 cm) neck height was recorded in Afghan white at 1st Oct. planting and minimum (4.30 cm) was noted in NARC-91 at 15th Oct. planting. This may be due to the response of different genotypes to different temperature level.

Number of bulbs per kg: Statistical analysis showed significant difference in planting dates and varieties while their interaction had non- significant effect (Table 4). Significantly more number of

Table 4: Number of bulbs per kg in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	14.00	23.67	39.00	25.56b
Swat-I	14.67	22.67	37.33	24.89b
Swat-local	15.33	29.67	39.67	28.22b
NARC-91	13.33	30.00	36.67	26.67b
Cross-bow	73.33	123.33	126.67	107.78a
Means	26.13c	45.87b	55.87a	

LSD value ($P<0.05$) for sowing dates = 8.137, varieties = 10.50

Table 5: Single bulb weight (gm) in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	70.01a	37.58b	26.40cd	44.66a
Swat-I	66.49a	36.10bc	25.69cd	42.76a
Swat-local	63.14a	32.26bcd	25.33d	40.27a
NARC-91	66.12a	33.01bcd	30.98bcd	43.37a
Cross-bow	12.38e	8.23e	7.59e	9.40b
Means	55.63a	29.44b	23.70c	

LSD value ($P<0.05$) for sowing dates =4.727, varieties = 6.102 and interactions = 10.57

Table 6: Fresh yield per plot (kg) in onion crop as affected by sowing dates and varieties

	Sowing dates			
Varieties	1st Oct.	15 Oct.	31st Oct.	Means
Afghan white	90.50a	47.50bc	26.67ef	54.72d
Swat-I	101.67a	51.67b	37.50cde	63.61a
Swat-local	95.83a	45.83bcd	34.16de	58.61ab
NARC-91	95.83a	47.08bc	42.50bcd	61.81ab
Cross-bow	14.58fg	7.50g	4.00g	8.69c
Means	79.58b	39.92b	28.97c	

LSD value ($P<0.05$) for sowing dates = 5.738, varieties = 7.408 and interactions = 12.83

Means followed by different letters differ significantly at $P<0.05$

bulbs per kg (55.87) was found at 31st Oct. and small number of bulbs (26.13) was found at 1st Oct. planting. In case of varieties, maximum number of bulbs per kg (107.78) was observed in Cross-bow and minimum (24.89) was in Swat-1. In the interaction between planting dates and varieties, more number of bulbs per kg (126.67) was noted in Cross-bow at 31st Oct. planting and less number of bulbs per kg for planting dates and varieties were significantly different from each other. These results were in conformity with the work of Nes (1985) who reported that late sowing reduced bulb size. Khokhar *et al.* (1990), Mingochi and Mpanda (1992) also reported that early dates of sowing gave the highest bulb's weight.

Single bulb weight: The mean values for planting dates showed that maximum single bulb weight (53.63 g) was noted at 1st Oct. planting and minimum (23.20 g) at 31st Oct. planting (Table 5). The significant difference between varieties was also found higher (44.66 g) in Afghan white and lower (9.40 g) in Cross-bow. The interaction between sowing dates and varieties was also significant which was more (70.01 g) in Afghan white at 1st Oct. planting and less (7.59 g) in Cross-bow at 31st Oct. planting. Single bulb weight was significantly affected by planting dates and varieties (Table 3). Comparing the means of planting dates, 1st Oct. planting produced maximum (55.63 g) bulb weight and minimum (23.70 g) bulb weight at 31st Oct. planting. The results were in conformity with Singh and Singh (1975) and Mingochi and Mpanda (1992) they reported in their experiments that early date of sowing gave maximum bulb weight which was reduced by late sowing. While in case of interaction among planting dates and varieties, maximum bulb weight (70.01 g) was produced by Afghan white plant on 1st Oct. while less (7.5 g) by Cross-bow at

31st Oct. sowing. The results may be due to availability of more time for maturity in 1st Oct. crop, while as planting was delayed, bulb weight was decreased due to shorter time for maturity of crop.

Bulb yield (t ha^{-1}): Comparison of means for sowing dates showed maximum yield per hectare (79.58 tons) was recorded at 1st Oct. sowing, followed by 39.92 tons at 15th Oct. sowing (Table 6). The minimum yield per hectare (28.97 tons) was recorded at 31st Oct. sowing.

Comparing the means for varieties, the highest yield per hectare (63.61 tons) was observed in Swat-1. The minimum yield per hectare (8.69 tons) was recorded in Cross-bow. The interaction between sowing dates and varieties was also significant. The yield per hectare was more (101.67 tons) on Swat-1 at 1st Oct. sowing and less (4.00 tons) in Cross-bow at 31st Oct. sowing. These results were in conformity with the findings of Tomar *et al.* (1989) and Orlowski and Rekowsk (1992).

In conclusion, planting time greatly affected fresh yield and the land race varieties were performed best than exotic materials. It needs high attention that the foreign cultivars may be included in the cropping system after testing in the local research institutes. The results verify the scope of candidate cultivars that may be commercialized in near future.

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