

## Screening of Local Varieties of Onion for Bulb Formation

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### ABSTRACT

This study was conducted to screen the performance of 10 varieties of onion under the agro-climatic condition of D. I. Khan during 1999-2000. The varieties included Bannu Local, Bilot Kacha Local, Dark Red, Naurang Local, Peshawar Local, Paniyala Local, Phulkara, Shah Alam Local, Swat-I and Tank Local. Data on various growth parameters were recorded. Naurang Local and Peshawar Local contained the maximum seedling bulb diameter of 0.5 cm and 0.49 cm, respectively at the time of transplantation. The number of leaves of seedling plant<sup>-1</sup> was the same in all varieties. Shah Alam had the maximum number of leaves plant<sup>-1</sup>, leaf width and leaf length and number of leaves before transplanting. The varieties did not show significant difference in bulb diameter and whorl of the leaf. Total number of double split<sup>-1</sup> bulbs was maximum in Bannu Local. The cultivars Naurang Local possessed the maximum diameter (5.867cm), thick necked bulbs (226), weight of bulb (104.2 g), yield plot<sup>-1</sup> (14.75 kg) and yield ha<sup>-1</sup> (17.07 tons) and surpassed all the other varieties.

**Key Words:** Varieties; Onion; Bulb

### INTRODUCTION

Onion (*Allium cepa* L.) belongs to the family Amarayllidiaceae. It is one of the most important commercial vegetable crops and is widely grown in almost all the countries of the world. In addition to its medicinal value (Baloch *et al.*, 1994), it contains carbohydrates, protein, vitamin A, thiamine, riboflavin, niacin and ascorbic acid. Pandey and Mundra (1971) reported that application of nitrogen increased plant height, number of leaves, bulb length, diameter and yield of onion. Similarly, Baloch *et al.* (1994) found that application @ 125 kg N with 75 kg K<sub>2</sub>O gave the highest yield. Mangrio *et al.* (1987) reported that application @ 100 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> gave higher yield than 70 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and that K<sub>2</sub>O fertilizer did not show any significant effect on bulb yield.

Rashid and Rashid (1978) found that onion bulb size and weight increases with increasing inter and intra row spacing but recorded total bulb yield with closer spacing. They obtained the high bulb size and weight when seedlings were planted at ridges 60 cm apart with plant to plant distance of 10-15 cm. Sinclair (1983) planted nine onion cultivars between 10<sup>th</sup> July to 9<sup>th</sup> September and reported that bolting of bulb was higher in early crop as compared to late sowing. Similarly, delaying the sowing date shortened the cultural cycle of the onion cultivar but lead to small bulb size and lowest yield (Lisbao *et al.* 1985; Nes, 1985; Guerra, 1987; Tomer *et al.*, 1988). Dumitrescu and Radaoi (1985) planted sets of 7-14 mm, 14-21 mm diameter at 360,000-560,000 sets ha<sup>-1</sup> on five dates from 10<sup>th</sup> September to 1<sup>st</sup> March. They obtained the highest yield (42 t ha<sup>-1</sup>) of good quality bulbs (108 g) by planting sets of 14-21 mm diameter on 10<sup>th</sup> September at 460,000 sets ha<sup>-1</sup>. Iqbal *et al.* (1990) reported greater bulb formation and higher weeds from weed controlled plants of onion as compared to uncontrolled

plots. Imtiyaz and Singh (1990) recorded the lowest yield when irrigation was withheld from beginning of bulb formation stage till its completion whereas the highest yield was obtained when crop was irrigated throughout growth and development.

A cultivar performs differently under different agro-climatic conditions and various cultivars of the same species grown even in the same environment often yield differently. The performance of a cultivar mainly depends on the interaction of genetic makeup and environment. Therefore, these two factors provide an idea for the selection of a specific variety for specific locality. The present study envisages the evaluation and selection of 10 locally available onion varieties for good quality bulb formation.

### MATERIALS AND METHODS

The experiment was conducted at the experimental area of Horticulture Department, Faculty of Agriculture, Gomal University, D.I. Khan during 1999-2000. The experiment was laid in Randomized Complete Block Design with three replications. Each plot comprised of 12 rows of 2.4 m long and 30 cm apart. Plant to plant and row to row spacing were 10 cm. Fertilizer was applied at the recommended dose of 120:60:60 Kg ha<sup>-1</sup> of NPK. All Phosphorus, Potassium and half of the Nitrogen were applied at the time of soil preparations; whereas, the other half nitrogen dose was applied 30 days after transplanting. All the required cultural practices such as irrigation, weeding, pest and disease control etc. were given uniformly to all the varieties. The varieties under test were Bannu Local, Bilot Kacha Local, Dark Red, Naurang Local, Peshawar Local, Paniyala Local, Phulkara, Shah Alam Local, Swat-I and Tank Local.

Data were recorded on days required for starting germination, days required for complete germination,

seedling leaf size, seedling bulb size, leaf erectness, leaf waxiness, nature of storage organ, uniformity of bulb shape, bulb structure, bolting, leaf color, bulb flesh color, intensity of flesh color if red, shape of full grown bulb, skin number, flavor rating, thick necked bulbs, double split<sup>-1</sup> bulbs, marketable yield, number of bulbs survived plot<sup>-1</sup>, yield plot<sup>-1</sup> (kg), yield in tons hectare<sup>-1</sup>, bulb skin color, skin thickness, number of leaves, width of leave, length of the leaf, total number of the bulb, bulb diameter (cm), maximum bulb diameter, weight of the single bulb (g), and leaf whorl in bulb. The data collected on various parameters were analyzed statistically using analysis of variance Technique as described by Steel and Torrie (1980) and Duncan's Multiple Range Test (Duncan, 1955) was used to check the difference among treatment means.

## RESULTS AND DISCUSSION

**Seedling bulb diameter (cm).** Seedling bulb diameter is a measure of healthy growth. Means in Table I revealed that local onion varieties were significantly variable with regards to seedling bulb diameter. The largest (0.5 cm) seedling bulb diameter was recorded in cv Naurang local which was at par with Peshawar local, Panyala local and Bilot Kacha. The smallest bulb diameter was noted in Phulkara variety followed by Shah Alam local and Swat-I producing bulbs of 0.41 cm diameter which were alike.

**Seedling leaf length (cm).** A perusal of the means of seedling leaf length (Table I) indicated significant variations among onion varieties. The seedling of Naurang Local contained the most lengthiest (36.4 cm) leaves followed by Bilot Kacha, Swat-I and Shah Alam with leaf length of 34.71, 34.08 and 33.55 cm, respectively. Onion variety Phulkara leaves had the smallest (28.05 cm) length.

**Number of leaf seedling<sup>-1</sup>.** All the onion varieties had three leaves before transplanting (Table I).

**Number of leaves plant<sup>-1</sup>.** The number of leaves is an important yield component. Leaves manufacture food with the help of chlorophyll and translocate it down for bulb development. A perusal of the means table (Table I) depicted significant variability for the number of leaves

among onion varieties evaluated. The maximum number (13) of leaves was recorded in variety Shah Alam followed by Tank Local and Dark Red with 12.60 and 11.47 leaves plant<sup>-1</sup>, respectively and was statistically similar. The lowest (8.2) number of leaves plant<sup>-1</sup> were recorded in Cv Paniyala local.

**Length of leaf (cm).** The means in Table I showed that onion varieties differed significantly with respect to length of leaves. The lengthiest leaves (55.8 cm.) were measured in cv Shah Alam followed by Swat-I. Naurang local and Peshawar local with leaf length of 46.8, 43.6 and 41.63 cm, respectively. However, these varieties differed significantly the shortest leaves of 36.20 cm was noted in Bannu local and Tank local.

**Bulb diameter.** Bulb diameter contributes significantly to yield of crop component. A perusal of the bulbs diameters means (Table II) showed that the varieties under test did not vary statistically in bulb diameter. However, the bulbs of the largest diameter (4.893 cm) were observed in Cv Naurang local followed by Tank local and Dark Red with 4.863 and 4.80 cm bulb diameters, respectively. The bulbs of smallest diameter (2.42 cm) were noted in Bannu Local.

**Maximum bulb diameter.** The data regarding maximum bulb diameters are given in Table II. Significant variations in the bulb diameters exhibited among onion varieties. The maximum diameter of 5.867 cm was recorded in Naurang local followed by Dark Red and Bilot Kacha. All the three varieties were statistically at par. The minimum bulb diameter (3.633 cm) was observed in Peshawar local.

**Number of split/double bulbs.** Split/double bulbs are an important measure of quality. A perusal of the means (Table II) showed that onion varieties varied significantly in number of split/double bulbs. The onion varieties Panyala local, Phulkara, Tank were devoid of split/double bulbs. The highest number (48.00) of split/double bulbs were recorded in cv Bannu local which differed significantly from all the other varieties. The cv Peshawar Local ranked second with 18.67 of split/double bulbs whereas 16.67 split/double bulbs were found in Shah Alam.

**Thick necked bulbs.** Thickness of neck is an important parameter that determines the storability qualities of onion

**Table I. Screening of seedling bulb diameter, seedling leaf length, number of leaves/seedling, number of leaves/plant and length of leaf (cm)**

Varieties	Seedling diameter (cm)	Seedling Leaf Length (cm)	Seedlings Number of Leaves/Plant	No. of leaves per plant	Length of leaf (cm)
Bannu Local	0.4300 bc	30.20 cd	3.000	10.40 cde	36.20 e
Bilot Kacha	0.4600 abc	34.71 ab	3.000	9.400 def	36.60 de
Dark Red	0.4200 bcd	33.17 abc	3.000	11.47 abc	38.80 d
Naurang Local	0.5000 a	36.44 a	3.000	10.80 bcd	43.60 c
Peshawar Local	0.4900 a	29.88 cd	3.000	8.907 ef	41.63 c
Paniyla Local	0.4700 ab	31.50 bc	3.000	8.200 f	38.80 d
Phulkara	0.3700 d	28.05 d	3.000	9.400 def	36.00 d
Shah Alam Local	0.4100 cd	33.55 ab	3.000	13.00 a	55.80 a
Swat-I	0.4100 cd	34.08 ab	3.000	11.60 abc	46.80 b
Tank Local	0.4200 bcd	31.77 bc	3.000 NS	12.60 ab	36.20 e

**Table II. Screening of bulb diameter, maximum bulb diameter, total number of double/split bulb per plot, thick necked bulb per plot and weight of single bulb**

Varieties	Bulb diameter (cm)	Maximum bulb diameter (cm)	Total number of double/ split bulb per plot	Thick necked bulb per plot	Weight of single bulb (gm)
Bannu Local	2.420	4.333 bc	48.00 a	137.3 b	28.83 d
Bilot Kacha	4.693	5.433 a	2.333 c	201.0 ab	88.15 ab
Dark Red	4.80	5.767 a	0.666 c	196.0 ab	79.72 b
Naurang Local	4.893	5.867 a	0.333 c	226.0 a	104.2 a
Peshawar Local	2.513	3.633 c	18.67 b	52.33 c	27.91 d
Paniyala Local	4.797	5.467 a	0.000 c	234.0 a	72.65 bc
Phulkara	4.227	5.700 a	0.000 c	194.7 ab	61.02 c
Shah Alam Local	4.667	5.467 a	16.67 b	154.3 b	59.25 c
Swat-I	4.367	5.300 ab	3.000 c	186.7 ab	73.31 bc
Tank Local	2.863 NS	4.200 c	0.000 c	179.00 ab	40.61 d

varieties. The onion varieties significantly differed in the number of thick necked bulbs present in each plot. The onion variety Panyala contained the maximum number of (234) of thick necked bulbs followed by Naurang local and Bilot Kacha with 226 and 201 thick necked bulbs. The lowest number (152.33) thick necked bulbs were noted in Peshawar local.

**Weight of single bulb.** Bulb weight is very important parameter that contributes towards the yield. The single bulb weight means (Table II) indicated that single bulb's weight differed significantly different among the onion varieties evaluated. The weight of single bulbs in Naurang local was the heaviest (104 g) and was significantly heavier than the bulbs weight in all the other cultivars except Bilot Kacha which had single bulbs of 88.15 g. The highest single bulbs of (27.91 g) were produced in cv Peshawar Local.

**Bolting percentage.** Bolting is a problem of physiological nature and is undesirable for better bulb production. The data regarding bolting percentage is summarized in Table III. No significant variation existed among the varieties. However, the maximum bolting percentage was recorded in Cv Bilot Kacha (15.20) followed by Tank Local (12.35), Naurang Local (11.19), Dark red (9.07), Peshawar Local (7.5), Bannu Local (5.91), Paniyala Local (4.29), Shah Alam (1.98) and Swat-1 (1.52) The minimum bolting percentage was recorded in Phulkara (0.62).

**Bulb survival percentage.** The highest bulb survival (Table III) percentage (86.22) was recorded in cv Paniyala Local, followed by Naurang Local (80.67) and Bannu Local (86.20). The survival percentage of bulbs in Tank Local, Bilot Kacha Local, Swat-1, Dark red, Phulkara and Shah Alam Local were (78.70), (76.85), (75.22), (73.61) and (70.13). The lowest bulbs survival percentage (69.44) was recorded for Peshawar Local.

**Yield t ha<sup>-1</sup>.** Onion bulbs yield is the parameter that matters. A perusal of the yield means (Table III) depicted that onion varieties significantly differed in the bulb yield ha<sup>-1</sup>. The highest yield of 17.07 t ha<sup>-1</sup> was harvested in the onion variety Naurang local which was statistically at par with Bilot Kacha (14.5 t) and Panyala local (13.41 t) and significantly different from the bulb yields obtained in the

other onion varieties used in the experiment. The lowest yield of 6.462 t ha<sup>-1</sup> was produced from Bannu local. Hence, Naurang Local, Bilot Kacha, Dark Red and Paniyala Local varieties are recommended for higher yield/Bulb production.

**Table III. Screening the bolting percentage, survival percentage of onion and yield tons**

Varieties	Bolting Percentage	Survival Percentage	Yield (t ha <sup>-1</sup> )
Bannu Local	5.91	80.20	6.462 e
Bilot Kacha	15.20	76.85	14.54 ab
Dark Red	9.07	75.22	13.70 abc
Naurang Local	11.19	80.67	17.07 a
Peshawar Local	7.5	69.44	5.227 e
Paniyala Local	4.29	86.22	13.41 abc
Phulkara	0.62	73.61	9.066 cde
Shah Alam Local	1.98	70.13	8.217 de
Swat-I	1.52	75.80	12.15 bcd
Tank Local	12.35 NS	78.70	7.619 de

**Leaf color.** From data (Table IV), it was observed that varieties Dark Red, Norange, Peshawar, Swat-I had dark green leaf colour and cvs Bannu Local, Bilot Kacha, Phulkara and Tank Local had light green leaves while mid green colored leaves were observed in Shah Alam Local variety. Majority of the varieties had leaves light Green color while four of them were found with dark green color. Only one Shah Alam Local had medium green leaf color.

**Leaf erectness.** The data (Table IV) reveal that all the varieties had erect leaves except Shah Alam. Nine local varieties produced leaves erect in nature; one variety had leaves bowed down.

**Leaf waxiness.** The data (Table IV) show that Bannu Local Bilot Kacha, Norange, and Phulkara had little waxy leaves. However, Peshawar Local, Paniyala Local, Swat-I and Tank Local leaves were moderately waxy while Shah Alam very waxy leaves. Four local varieties were little waxy and four local varieties moderately waxy and were in waxy except one very waxy on them.

Almost similar results were reported by Dubey (1994) who compared 37 onion cultivars and found that maximum

**Table IV. Leaf color, Erectness, Waxiness, Nature of Storage Organ, Uniformity of Bulb Shape and Structure of Bulb**

Varieties	Leaf color	Leaf erectness	Leaf waxiness	Nature & storage Organ	Uniformity of bulb shape	Structure of bulb
Bannu Local	Light green	Erect	Little waxy	Single & double bulb	Moderately uniform	Highly double
Bilot Kacha	Light green	Erect	Little waxy	Single bulb	Very uniform	Highly single center
Dark Red	Dark green	Erect	Waxy green	Single bulb	Very uniform	Highly single center
Naurang Local	Dark green	Erect	Little waxy	Single bulb	Very uniform	Highly single center
Peshawar Local	Dark green	Erect	Moderately waxy	Single bulb	Moderately uniform	Highly single center
Paniyala Local	Light or mid green	Erect	Moderately waxy	Single bulb	Very uniform	Single internal doubling
Phulkara	Light green	Erect	Little waxy	Single bulb	Very uniform	Highly single center
Shah Alam Local	Mid green	Leaves fall down	Very waxy	Single or double bulb	Moderately uniform	Highly single center
Swat-I	Dark green	Erect	Moderately waxy	Single bulb	Very uniform	Highly single center
Tank Local	Light green	Erect	Moderately waxy	Single bulb	Very uniform	Highly single center

**Table V. Bulb skin color, flesh color, intensity of flesh color if red, shape of full grown bulb, bulb skin thickness, bulb skin number and flavor rating**

Varieties	Bulb skin color	Bulb flesh color	Intensity of flesh color, if red	Shape of full grown bulb	Bulb skin thickness	Skin number	Flavor rating
Bannu Local	Red	Light yellow	All through bulbs	Pear	Thick	1-2	Moderately pungent
Bilot Kacha	Light red	White	---do---	Rhombic	Thick	2-3	Very pungent
Dark Red	Red	Red white	---do---	Broad ovate	Thick	1-2	Very pungent
Naurang Local	Golden yellow	Red white	---do---	Ovate	Medium	1-2	Very pungent
Peshawar Local	Red	Red white	---do---	Thick flat	Medium	1-2	Moderately pungent
Paniyala Local	Light red	Yellow	---do---	Broad ovate	Medium	1-2	Sweet
Phulkara	Light Red	White	---do---	Broad ovate	Thick	1-2	Pungent
Shah Alam Local	Light red & white	White	---do---	Ovate or spindle	Thick	1-2	Sweet
Swat-I	Dark red	Red	---do---	Flat globe	Thick	1-2	Moderately pungent
Tank Local	Light red	White	---do---	Flat globe	Thick	1-3	Very pungent

number of cultivars produced light green colors. Similarly, moderate to very waxy leaves were reported for maximum number of cultivars.

**Nature of storage organ, uniformity of bulb shape and bulbs structure.** Regarding the nature of storage organ, all varieties produced single bulb except Bannu Local and Shah Alam. Bannu and Shah Alam also produced single and double bulbs.

Bannu Local and Shah Alam Local bulbs were moderate uniform shape while the rest of the variety produced very uniform shape i.e. Bilot Kacha Local, Dark Red, Naurang Local, Paniyala Local, Phulkara, Swat-I and Tank Local.

The varieties bulb structure differed from each other. It varied from highly single centered to highly double structure of bulb. Similar result had been reported by Dubey (1994).

**Bulb skin color.** Three for the Local varieties had bulb skin of red color, five with light red color bulb, one of golden yellow and two were light red and white. Four varieties had white flesh color, three varieties of red white flesh color and one each of yellow, light yellow and red flesh color. The intensity of flesh color if red throughout the bulb was similar in all varieties. Mamodou and Djiby (1994) recorded similar observations.

**Shape of bulb.** The shape of full grown bulb of Bannu Local was pear type, Bilot Kacha Local, Rhombic, Dark Red, Paniyala Local, Phulkara bulbs were broad ovate whereas the bulbs of Naurang ovate, Peshawar, flat, Shah Alam and Swat-I were ovate flat, ovate spindle and flat

globe respectively. Similar results were reported by Dubey (1999).

**Bulb skin thickness, bulb skin number and flavour rating.** Most of the varieties had thick skin (Table V) which include Bannu Local, Bilot Kacha Dark Red, Phulkara, Shah Alam, Swat-I and Tank Local. The cv Naurang Local, Peshawar Local and Paniyala Local had medium skin thickness.

The most of the Local varieties had 1-2 number of skins (Table V). Bannu Local, Dark Red, Naurang, Peshawar, and Paniyala, Phulkara, Shah Alam and Swat-I included in this group. The skin numbers up to three were recorded in Bilot Kacha and Tank Local.

**Flavor rating.** It was observed that majority of the varieties have very pungent taste or flavor (Table V). These varieties are Bilot Kacha Local, Dark Red, Naurang Local and Tank Local. The varieties with moderately pungent flavor are Bannu Local, Peshawar Local, and Swat-I. However, only two varieties are sweet i.e. Paniyala and Shah Alam Local.

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