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PRODUCTION OF HIGH QUALITY BULBOUS FLOWERS IN POTHWAR

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Abstract

The Pothwar Plateau in Pakistan is bestowed with comparatively moderate climate quite suitable for the production of high-value bulbous flowers, especially winter and early spring bulbous flowers. Cut flowers and potted plants can be produced in this region during the off-season (without glasshouse heating) and transported to markets in cold climate countries. Adaptability of important winter/early spring bulbs was studied for two years and it was concluded that Daffodil, Jonquil, Freesia, Dutch Iris, Hyacinth, Sparaxis, Gladiolus and Ranunculus can successfully be grown and further propagated in Pothwar climate. Tulip and Crocus produced low quality flowers but the bulbs were degenerated. For the production of high quality cut flowers and bulbs, factors influencing growth and development were studied. Production technology including sowing date and plant density for various bulbous flowers was studied. Floral parameters and bulb yield exhibited significant differences for various treatments. In case of Daffodil, Jonquil, Dutch Iris and Hyacinth, 15th October sowing and plant density 13.4 plants m^{-2} gave best performance. Freesia, and Sparaxis performed best on 15th October sowing and with 18.3 plants m^{-2},plant density whereas, Ranunculus gave best performance when sown on 1st October with plant density of 8.14 plants m^{-2}.

Key words: Bulbous flowers, Adaptability, Sowing date, Plant density, Pothwar

INTRODUCTION

The cultivation of bulbous flowers is no longer limited to countries with moderate climate. The Pothwar plateau in Pakistan is bestowed with comparatively moderate climate suitable for the production of high value bulbous flowers, especially the winter and early spring bulbous flowers. The regions with high light intensity and appropriate winter temperatures are suitable for Narcissus bulbous flower development, cut flowers and potted plants can be produced in these areas during the off-season for export (Kamenetsky, 2003). Bulbous flowers are considered to be premium quality cut flowers and the potential for flower production in Pothwar is evident; as the light intensity is relatively high and winter temperatures are appropriate for flower development (Fig 1). After the flower-bud initiation, Narcissi require low temperature which may be satisfied by growing the bulbs outdoors in the temperate climates. Furthermore, longer photo-period promotes stem length in Narcissi (Stevens, 1977). Hand digging and ploughing 30 cm deep

or rotavating 17.5-22.5 cm deep did not show any variation in yield and quality of Narcissus bulbs and flowers (Jefferson-Brown, 1969). The flowering percentage was found to be 80% in Narcissus bulbs weighing 45-55 g each (Kruyer, 1981). However, delayed planting of Narcissi resulted in poor quality flowers and low bulb yield (Jefferson-Brown, 1969). In South-West and Eastern England, the Narcissi plant population ranges from 12 to 20 thousand per acre depending upon the size of the bulb (Rees et al., 1968). Stevens (1977) recommended Narcissi planting 10-15 cm apart in single, double or triple rows separated by 60-80 cm wide path. Banker (1991) reported that flower initiation in tuberose planted at 25 cm grid started 110 days after planting (49%) which was further increased to 87.2% (126 days after planting). In Narcissus, earlier and greater development of the terminal mother bulb unit in year one gave earlier flowering and a greater daughter bulb unit weight (Wurr et al., 2001).

The present study was carried out to explore the possibility of early spring bulbous flower production under natural conditions in Pothwar area.

MATERIALS AND METHOD

The study was carried out at Barani Agricultural Research Institute, Chakwal during the years 2003-04, 2004-05 and 2005-06. Research material comprised of Narcissi (Daffodil and Jonquil), Freesia, Dutch Iris, Hyacinth, Sparaxis, Tulip, Crocus, Gladiolus and Ranunculus.

The experiment was laid out in Randomized Complete Block Design in factorial fashion. Two sowing date treatments were SD_1 (15th October) and SD_2 (30th October) for Narcissi, Dutch Iris, Hyacinth, Freesia and Sparaxis. Whereas, sowing date 1st October was SD_1 and 15th October was SD_2 for Ranunculus. Planting density was maintained at 22 plants m^{-2} (PD_1) and 13.4 plants m^{-2} (PD_2) for Narcissus, Dutch Iris and Hyacinth. For Freesia and Sparaxis, 25.6 plants m^{-2} (PD_1) and 18.3 plants m^{-2}(PD_2). For Ranunculus, PD_1 and PD_2 were 13.4 plants m^{-2} and 8.14 plants m^{-2}, respectively. The planted bulb weight was same as mentioned in adaptability study for all bulb flowers included. The chemical fertilizer @ 50-200-50 NPK g m^{-2}, farm yard manure and compost mixture (1:1) @ 5 kgm^{-2} were applied to enrich and improve physical soil conditions for better growth. Irrigations were applied in a balanced way as and when required through-out the growing period. Normal cultural practices were made to maintain proper growth of the plants. At the end of growing period, bulbs were lifted and stored at room temperature every time.

Data were recorded regarding days to 50% flowering, stalk length, number of florets $stalk^{-2}$ (where needed), planted and harvested bulb weight. Data were analyzed according Fisher's analysis of variance technique and treatments were compared using DMR/LSD test at 5% probability level (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Adaptability studies on winter and early spring bulbs revealed (Table 1) that Daffodil, Jonquil, Dutch Iris, Hyacinth, Sparaxis, Freesia and Ranunculus produced flowers and bulbs of commercial grade with stalk length of 40.3, 35.4, 40.7, 16.2, 16.1, 25.9 and 17.8 cm during 2003-04 respectively, while it was 41.2, 34.9, 39.3, 15.8, 15.8, 30.1, 18.3 cm during 2004-05 respectively. Gladiolus produced medium stalk length of 37.5 cm and 38.2 cm during 2003-04 and 2004-05,respectively. Whereas Tulip and Crocus produced flowers of less economic value and bulbs were degenerated too. It gave a clue that Daffodil, Jonquil, Dutch Iris, Hyacinth, Sparaxis, Freesia and Ranunculus have promising future for cut flower production in Pothwar area. Further study regarding planting time and planting density is discussed as follows:

Daffodil

Data tabulated in Table 2 revealed that sowing date and planting density had significant effect on different traits of Daffodils. Maximum stalk length of 44.8 cm was obtained when planted on October 15 (SD_1) at plant density of 13.4 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. Maximum harvested bulb weight (75.5 g) was achieved when bulbs were planted on October 15 at plant density of 13.4 plants m^{-2} while least bulb weight of

60.8 g was obtained at SD_2 and PD_1, suggesting that longer growing period and spaced planting promoted harvested bulb weight. As regards days to flower and flower diameter, minimum days taken to flower (110) were recorded for SD_2 and PD_2, while maximum flower diameter (8.3 cm) was recorded at SD_1 and PD_2 suggesting that early sowing at spaced planting promoted flower size while late planting and thick plant density decreased it. These results are in concurrence to those of Wurr et al. (2001).

Jonquil

Data displayed in Table 3 depicted that sowing date and planting density had significant effect on different traits of Jonquil. Maximum stalk length of 37.5 cm was recorded when planted on October 15 (SD_1) at plant density of 13.4 plants m^{-2}(PD_2), while it decreased with late planting and higher plant density. Highest harvested bulb weight (165.3 g) was achieved when bulbs were planted on October 15 at plant density of 13.4 plants m^{-2}, while least bulb weight of 122.6 g was recorded at SD_2 and PD_1, suggesting that shorter growing period and thick planting decreased harvested bulb weight. Number of florets per spike and flower diameter increased at SD_1 and PD_2. As regards days to flower, minimum days taken to flower (103) were achieved for SD_1 and PD_2, suggesting that early sowing at spaced planting increased flower size and number of florets per spike and promoted earlier flowering. These results are similar to those of Wurr et al. (2001).

Dutch Iris

Data presented in Table 4 exhibited that sowing date and planting density had significant effect on different traits of Dutch Iris.Maximum stalk length of 48.2 cm was obtained when planted on October 15 (SD_1) at plant density of 13.4 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. The results are in concurrence to that of Stevens (1977).What was his findings?. Highest harvested bulb weight (74.4 g) was achieved when bulbs were planted on October 15 at plant density of 13.4 plants m^{-2}, while least bulb weight of 47 g was obtained at SD_2 and PD_1, suggesting that longer growing period and spaced planting promote harvested bulb weight owing to more photosynthetic activity. As regards days to flower, minimum days to flower (134) were recorded for SD_2 and PD_2 indicating completion of growing period in shorter span.

Hyacinth

Data in Table 5 revealed that sowing date and planting density had significant effect on different traits of Hyacinth. Maximum stalk length of 18.4 cm was obtained when planted on October 15 (SD_1) at plant density of 13.4 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. The results are same as those of Wurr et al. (2001).What about their results? Highest harvested bulb weight (53.8 g) was achieved when bulbs were planted on October 15 at plant density of 13.4 plants m^{-2}, while least bulb weight of 46.4 g was obtained at SD_2 and PD_1, suggesting that longer growing period accumulate more harvested bulb weight. As regards days to flower and diameter, minimum days taken to flower (124) were recorded for SD_2 and PD_2, while maximum number of florets (13.1) were recorded at SD_1 and PD_2 suggesting that early sowing at spaced planting increased number of florets per spike while late planting and thick plant density decreased it.

Freesia

Data displayed in Table 6 revealed that sowing date and planting density had significant effect on different traits of Freesia. Maximum stalk length of 32.4 cm was obtained when planted on October 15 (SD_1) at plant density of 18.3 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. Highest harvested bulb weight (14.2 g) was recorded when bulbs were planted on October 15 at plant density of 18.3 plants m^{-2}, whereas least bulb weight of 10.7 g was obtained at SD_2 and PD_1, suggesting that longer growing period promote harvested bulb weight. The results are in concurrence to that of Stevens (1977). What about his results? As for as days to flower are concerned, 134 days were taken to flower at SD_2 and PD_2 thereby indicating that plant terminates its vegetative growth earlier.

Sparaxis

Data presented in Table 7 showed that sowing date and planting density had significant effect on different traits of Sparaxis. Maximum stalk length of 21.8 cm was recorded when planted on October 15 (SD_1) at plant density of 18.3 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. Highest harvested bulb weight (10.7 g) was achieved when bulbs were planted on October 15 at plant density of 18.3 plants m^{-2}, while least bulb weight of 7.6 g was obtained at SD_2 and PD_1, suggesting that longer growing period and spaced planting increased harvested bulb weight. The results are same to those of Wurr et al. (2001).What about their findings? As regards days to flower, minimum days taken to flower (139) were recorded for SD_2 and PD_2.

Ranunculus

Data in Table 8 depicted that sowing date and planting density had significant effect on different traits of Ranunculus. Maximum stalk length of 25.8 cm was obtained when planted on 1st October (SD_1) at plant density of 8.14 plants m^{-2} (PD_2), while it decreased with late planting and higher plant density. Highest harvested bulb weight (16.7 g) was achieved when bulbs were planted on 1st October at plant density of 8.14 plants m^{-2}, while least bulb weight of 10.1 g was obtained at SD_2 and PD_1, suggesting that longer growing period and spaced planting promote harvested bulb weight. The results are in concurrence to those of Stevens (1977) and Wurr et al. (2001). As regards days to flower and flower diameter, minimum days taken to flower (149) were recorded for SD_2 and PD_2, while maximum flower diameter (4.8 cm) was recorded at SD_1 and PD_2 suggesting that early sowing at spaced planting promoted flower size while late planting and thick plant density decreased it.

CONCLUSIONS

In case of Daffodil, Jonquil, Dutch Iris and Hyacinth, 15th October sowing and plant density 13.4 plants m^{-2} gave best performance. Freesia and Sparaxis performed best on 15th October sowing with plant density 18.3 plants m^{-2}, whereas Ranunculus gave best performance when sown on 1st October and at a plant density of 8.14 plants m^{-2}. The results showed that Daffodil, Jonquil, Dutch Iris, Freesia, Sparaxis and Ranunculus have bright future for cut flower production in Pothwar area. The study emphasized to explore further, the various aspects of bulbous flower production in Pothwar region.

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Table 1: Adaptability study of important winter/early spring bulbous flowers

Flower	Plant density (plants m^{-2})	Bulb wt. $plant^{-1}$ (g)		Flower stalk length (cm)		Wt. of harvested bulb $plant^{-1}$ (g)	
		2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
Daffodil	22	31.6	30.7	40.3	41.2	64.2	62.4
Jonquil	22	55.7	57.6	35.4	34.9	135.4	133.7
Dutch Iris	22	20.7	21.4	40.7	39.3	75	73.6
Hyacinth	22	25.5	23.9	16.2	15.8	40.3	43.1
Tulip	22	25.9	25.2	20.4	22.3	5.6	7.3
Freesia	36	6.5	7.3	25.9	30.1	12.5	13.4
Crocus	36	5.1	5.2	-	-	1.3	2.1
Sparaxis	36	4.3	4.1	16.1	15.8	7.2	8.2
Ranunculus	18.3	4.7	4.5	7.8	18.3	16.1	16.3
Gladiolous	22	30.2	29.8	37.5	38.2	62.4	64.7

Table 2: Effect of planting time and density on Daffodil

Sowing date	Planting density	Days to flower (number)	Stalk length (cm)	Flower diameter (cm)	Harvested bulb weight (g)
SD1	PD_1	117	41.1	7.5	64.3
	PD_2	114	44.8	8.3	75.5
SD2	PD_1	111	31.1	6.7	60.8
	PD_2	110	31.9	7.1	63.2
LSD(0.05)		1.7	1.13	0.37	2.52

Table 3: Effect of planting time and density on Jonquil

Sowing date	Planting density	Days to flower (number)	Stalk length (cm)	Florets per spike	Flower diameter (cm)	Harvested bulb weight (g)
SD_1	PD_1	104.3	33.3	10.6	3.3	131.3
	PD_2	102.5	37.5	11.0	3.5	165.3
SD_2	PD_1	113	31.34	10.34	3.3	122.6
	PD_2	112	31.14	10.6	3.4	124.5
LSD (0.05)			1.68	0.46	0.05	4.5

Table 4: Effect of planting time and density on Dutch Iris

Sowing date	Planting density	Days to flower (number)	Stalk length (cm)	Harvested bulb weight (g)
SD_1	PD_1	143	43.9	60.4
	PD_2	141	48.18	74.35
SD_2	PD_1	137	34.78	47.03
	PD_2	134	38.73	55.4
LSD (0.05)		0.81	1.45	1.99

Table 5: Effect of time and density on hyacinth

Sowing date	Planting density	days to flower (number)	Stalk length (cm)	Florets per spike	Harvested bulb weight (g)
SD_1	PD_1	132	15.68	9.93	50.88
	PD_2	129	18.4	13.13	53.83
SD_2	PD_1	126	14.28	8.38	46.4
	PD_2	124	15.58	11.28	49.08
LSD (0.05)		0.85	0.61	0.5	1.58

Table 6: Effect of planting time and planting density on Freesia

Sowing date	Planting density	days to flower (number)	Stalk length (cm)	Harvested bulb weight (g)
SD_1	PD_1	146	26.33	12.23
	PD_2	141	32.4	14.2
SD_2	PD_1	137	22.15	10.65
	PD_2	134	24.26	11.48
LSD(0.05)		1.14	0.02	1.25

Table 7: Effect of planting time and density on Sparaxis

Sowing date	Planting density	days to flower (number)	Stalk length (cm)	Harvested bulb weight (g)
SD_1	PD_1	147	17.4	8.13
	PD_2	145	21.83	10.73
SD_2	PD_1	140	14.5	7.63
	PD_2	139	16.6	8.1
LSD (0.05)		1.07	0.98	0.57

Table 8: Effect of planting time and density on Ranunculus

Sowing date	Planting density	Days to flower (number)	Stalk length (cm)	Flowers plant^{-1} (number)	Flower dia (cm)	Harvested bulb weight (g)
SD_1	PD_1	159	19.1	13.2	4	13.5
	PD_2	155	25.8	15.6	4.8	16.7
SD_2	PD_1	150	14.6	9.3	3.3	10.1
	PD_2	149	17.9	11.2	3.9	12.4
LSD (0.05)		3.25	1.91	0.51	0.24	0.45

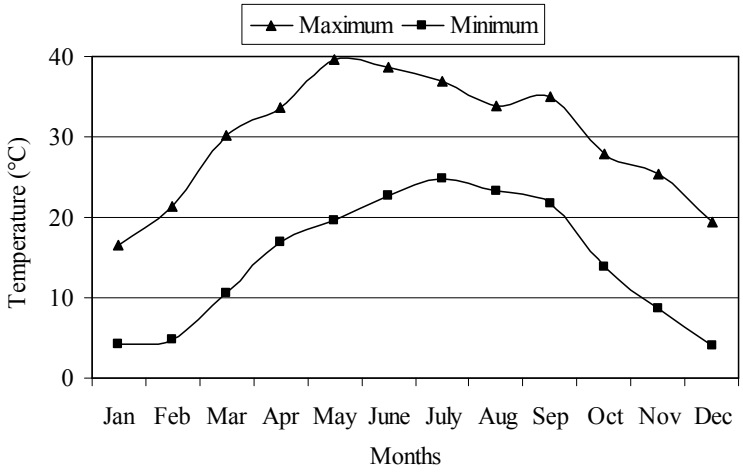

Figure1: Maximum and minimum temperature at Chakwal