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Effect of time of planting and spacing on the quality seed production of okra cv. Pusa Bhindi-5

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Abstract

The present investigation entitled "Effect of time of sowing and spacing on seed yield and quality in okra cv. Pusa Bhindi-5 was carried out at Research Farm, Division of Vegetable Science, IARI, New Delhi during Kharif-2017, The experiment consisted of three date of sowing, viz. D1 (15th June), D2 (30th June), D3 (15th July) and three spacing i.e., 75×25cm (S1), 60×25cm (S2) and 50×25cm (S3). The experiment was laid out in Randomized Block Design (RBD) with four replications and the quantitative data recorded were subjected to analysis of variance. The time of sowing and spacing had significant influence on plant height and number of leaves at 30, 45 and 60 days after sowing. Time of sowing had also significantly affected the days to first flowering, number of pod per plant, seed yield per plant, seed yield per hectare and 1000 seed weight. Based upon the results obtained from this study, it was concluded that the higher seed yield with better quality trait in seed crop of okra cv. Pusa Bhindi-5 was obtained on 15th June sowing with the spacing of 50×25 cm under Delhi conditions.

Keywords: Planting date, Seed yield, Seed quality, Spacing, Okra.

Introduction

Okra [*Abelmoschus esculentus* (L) Moench] which belongs to family Malvaceae is commonly known as 'Bhindi' or lady's finger. It is a native of tropical Africa, and one of the important fruit vegetables grown for its tender green fruits. India ranks first in world's okra production with the production of around 6.0 million tons (72% of the total world's production) from an area of 0.50 million hectares with an average productivity of 11.8 tonnes/ha and contributes about 3.9% in vegetable production basket (NHB 2017). Although Indian okra productivity is higher than the global productivity but its cultivation faces various challenges of diseases and pest mainly *kharif* season as compared to summer season. A number of high yielding, disease resistant varieties/hybrid have been developed but, the availability of quality seed with affordable price of those varieties/hybrids is still one of the limiting factor in okra cultivation specially in summer season when farmer use higher quantity of quality seed for growing early crop. Thus, to ensure the supply of quality seed in required quantity at affordable price, it is imperative to standardize the time of sowing and spacing to ensure higher seed yield with better quality. However, the quality seed is always short in supply because of the lower seed yield and quality as affected by several other factors. The optimized plant growth, flowering, number of pods, seed yield per plant etc. contribute to the seed yield and quality but affected by time of sowing and spacing (Rastogi et al.1987). Keeping in view of the above facts the present study was carried out with following objectives to study the effect of time of planting on seed yield and quality and to study the effect of spacing on seed yield and quality.

Materials and Methods

The present research investigation was carried out during *kharif* 2017 at Research Farm, Division of Vegetable Science, IARI, New Delhi which is situated at 28º35' North latitude and 77º12' East longitude at an altitude of 228.6 meter above mean sea level. The laboratory observations on seed quality characters were carried out in seed testing lab of Division of Seed Science and Technology, ICAR-Indian Agricultural Research Institute, New Delhi. The experimental site comes under a semi-arid and sub-tropical climate characterized with extreme hot summer and cool winter. The soil of experimental site is clay loam in texture with normal organic content

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with slight salinity. The experiment consists of nine treatments involving three date of sowing (D), three spacing (S) and four replications with Randomized Block Design (RBD). A plot size of 6 m^2 (3×2m) was maintained for each treatment in each replication. Seeds were sown with 15 days interval starting from D1 (15th June), D2 (30th June) and D3 (15th July). The 12 hours water soaked seeds treated with thiram @ 3g per kg seeds was sown at three spacing S1 (75cm×25cm, 53,333 plants per hectare), S2 (60cm×25cm, 66,666 plants per hectare) and S3 (50cm×25cm, 80,000 plants per hectare). The recommended cultural practices were maintained as that of a commercial crop. All observations related to seed yield and quality, viz. Plant height at 30, 45 and 60 days (cm), Average number of leaves at 30,45 and 60 days, Days to first flower anthesis, Days to 50 per cent flowering, First node of flowering, Number of pods per plant, Average pod length (cm), Number of branches per plant, Average number of seeds per pod, Seed yield per plant (g), Seed yield per plot (g), Seed yield per hectare (kg), 1000 seed weight (g), Percent germination, Seedling length (cm), Seedling dry weight (g), Vigour index–I & II and Electrical conductivity were recorded as per standard protocol. Vigour index-I was calculated by multiplying germination percentage with seedling length. Vigour index-II was calculated by multiplying germination percentage with seedling dry weight. Statistical analysis was carried out as per Panse and Sukhatme (1967).

Results and Discussion

Effect of sowing time and spacing on plant growth characters: Seed characters, mainly seed yield and seed quality attributes were influenced by date of sowing and spacing during *kharif* season of 2017. Significant differences in plant height at 30 days, 45 days and 60 days of sowing were observed. The plant height increased with the time among the date of sowing with the higher plant height in D3 (58.81cm, 15th July) and lower plant height in D1 (52.38c m, 15th June) (Table 1). The time of sowing had significant effect on number of leaves at 30 days, 45 days and 60 days. The higher number of leaves at 45 days (21.18) and 60 days (29.43) were in D1 (15th June) sowing (Table 1). The findings of this experiment are not in agreement with Sharma *et al. (*2014) who reported higher plant height in June sowing as compared to late sowing may be due to the favourable climatic condition in early sown crop during the year of experiment. The better plant height in July sowing was due to onset of mansoon which caused high humidity and favourable temperature for growth of plant while in June due to harsh temperature the early flowering was recorded which reduced the vegetative growth in this experiment. Plant height at 60 days showed significant differences among spacing, while there was no effect of spacing on plant height at 30 days and 45 days. The maximum plant height was recorded in S3 (50×25 cm, 56.84cm) and both S1 and S2 had plant height of 54.35cm (Table 1). The increase in plant height in closer spacing is in agreement with Soni et al. (2006) and Pandey et al. (2012). Number of leaves at 30 days, 45 days and 60 days could not be influenced by spacing.

Effect of sowing time and spacing on flowering characters: The time of sowing also had significant influence on days to first flowering which ranged from 45.34 days to 52.90 days with more time taken in D3 (15th July) (Table 2). Although first node of flowering was significantly influenced by time of sowing, yet no trend could be established and first flowering observed on later node (9.15) in D2 (30th June) sowing. In Delhi, higher temperature in June caused stress to plants which

Table 1: Effect of sowing time and spacing on plant growth characters

Treatments/ characters	Plant height at 30 days (cm)	Plant height at 45 days(cm)	Plant height at 60 days(cm)	Number of leaves at 30 days	Number of leaves at 45 days	Number of leaves at 60 days
Sowing time (D)						
D1 (15th June)	19.98	38.91	52.38	11.3	21.18	29.43
D2 (30th June)	24.50	41.28	55.40	8.00	18.79	26.38
D3 (15th July)	37.06	49.17	58.81	7.06	17.17	24.78
SEm±	1.48	1.21	0.74	0.36	0.73	0.82
C D (P= 0.05)	3.16	2.59	1.57	0.77	1.56	1.76
Spacing (S)						
S1 (75×25 cm)	26.00	41.95	54.35	9.14	19.37	27.17
S2 (60×25 cm)	27.19	42.60	54.35	8.56	19.02	26.83
S3 (50×25 cm)	28.19	44.81	56.84	8.66	18.75	26.59
SEm±	1.47	1.21	0.74	0.36	0.73	0.82
C D (P= 0.05)	NS	NS	1.57	NS	NS	NS
Interactions(D×S)						
SEm±	2.56	2.1	1.27	0.62	1.26	1.43
C D (P= 0.05)	NS	4.49	2.72	NS	2.7	NS

resulted in early floweing. The less time taken for flowering in early sowing i.e. D1 (15th June) in confirmation with the results reported by Sharma et al. (2014) and Mohammadi et al. (2018) in okra. There was non-significant effect on the days to first flowering, first node of flowering and days to pod maturity. Days to pod maturity had shown significant difference among the time of sowing and early sowing D1(15th June) has taken less time for days to pod maturity (74.10) while more time was taken for pod maturity in D3(15th July) sowing (82.87) (Table 2). The less time taken in wider spacing for flowering and node of first flowering were in agreement with Bake et al. (2017).

Effect of sowing time and spacing on seed yield contributing characters: Significantly higher number of pods per plant (12.74) were recorded in early planting i.e. D1 (15th June) and there was a reduction in number of pods per plant in subsequent sowing i.e. 10.07 and 8.35 in D2 (30th June) and D3 (15th July) sowing respectively (Table 3). The higher number of pods in 15th June sowing was corroborated with findings of Sharma et al. (2014) and Pandey et al. (2012). The pod length and number of seed per pod could not be influenced with date of sowing hence recorded for non-significant effect. Seed yield per plant showed significant effect among the time of sowing. Early sowing D1 (15th June) had higher seed yield per plant (20.34g) and subsequent sowing had registered reduction in seed yield per plant. Seed yield per plot had shown significant difference among the date of sowing and the D1 sowing had given higher seed yield per plot (793.29g). The higher seed yield per plant in 15th June sowing was in confirmative with the results of Dhankhar et al. (2011) and Dhankhar et al. (2009).

Seed yield per hectare was higher in D1 (1322 kg) followed by D2 (1179.58 kg) with low seed yield (745.45 kg) in D3. Similar results have been reported by Sharma et al. (2014), Sonu et al. (2013) Dhankhar et al. (2011) and Dhankhar et al. (2009). Number of pods per plant showed significant effect among spacing, maximum number of pods per plant was recorded in spacing S1 (75×25cm, 11.23) and minimum pods were recorded on S3 (50×25cm, 9.71). Pod length and number of seeds per pod were not affected by spacing. Seed yield per plant showed significant effect among spacing, maximum number of seed yield per plant were recorded in S1 (75×25cm, 16.12g) and minimum seed yield per plant pods was recorded in S3 (50×25cm, 13.35g). Similar results were reported by Sharma et al. (2014), Sonu et al. (2013) and Moniruzzaman et al. (2008). Seed yield per plot showed significant effect among spacing, maximum seed yield per plot was recorded in spacing S3 (50×25cm, 645.80g) and minimum in S1 (75×25cm, 515.84.21g). Seed yield per hectare showed significant effect among spacing,

Table 3: Effect of sowing time and spacing on seed yield contributing characters

Treatments/ characters	Seed yield per plant (g)	Seed yield per plot (g)	Seed yield per hectare (kg)
Sowing time (D)			
D1 (15th June)	20.34	793.29	1,322.14
D2 (30th June)	14.07	707.75	1,179.58
D3 (15th July)	10.57	447.27	745.45
SEm±	0.43	29.55	49.25
C D (P= 0.05)	0.92	63.19	105.31
Spacing (S)			
S1 (75×25 cm)	16.12	515.84	850
S2 (60×25 cm)	15.52	620.8	1,033.33
S3 (50×25 cm)	13.35	645.8	1,066.66
SEm±	0.43	29.55	49.25
C D (P= 0.05)	0.92	63.19	105.31
Interactions (D×S)			
SEm±	0.74	51.19	85.31
C D (P= 0.05)	1.59	109.44	182.41

Table 2: Effect of sowing time and spacing on flowering characters

Treatments/ characters	Days to first flowering	First node of flowering	Days to pod maturity	Number of pod per plant	Pod length (cm)	Number of seeds per pod
Sowing time (D)						
D1 (15th June)	45.34	8.34	74.1	12.74	12.21	48.5
D2 (30th June)	48.69	9.15	77.51	10.07	12.26	38.68
D3 (15th July)	52.9	7.26	82.87	8.35	11.88	35.09
SEm±	0.59	0.39	0.47	0.47	0.26	0.94
C D (P= 0.05)	1.25	0.83	1.43	1.01	NS	NS
Spacing (S)						
S1 (75×25 cm)	48.7	8.48	77.95	11.23	12.4	49.27
S2 (60×25 cm)	49.19	8.07	78.22	10.22	12.19	48.07
S3 (50×25 cm)	49.06	8.2	78.3	9.71	12.11	42.93
SEm±	0.59	0.39	0.47	0.47	0.26	0.94
C D (P= 0.05)	NS	NS	NS	1.01	NS	NS
Interactions(D×S)						
SEm±	1.01	0.67	0.82	0.82	0.44	1.63
C D (P= 0.05)	NS	NS	NS	1.75	NS	NS

Table 4: Effect of sowing time and spacing on seed quality attributes

Treatments/ characters	Percent germination*	Seedling length (cm)	1000 seed weight (g)	Seedling dry weight (mg)	Seed vigour index I	Seed vigour index II	Electrical conductivity (μ mhos cm¯1 g¯1)
Sowing time (D)							
D1 (15th June)	90.67 (72.31)	24.52	47.26	60	2,223.23	8794.99	0.15
D2 (30th June)	88.44 (70.38)	23.39	44.68	74.44	2,068.62	6544..56	0.18
D3 (15th July)	86.78 (68.76)	22.55	38.96	96.67	1,956.89	5206.80	0.17
SEm±	1.48	1.22	0.56	9.51	114.77	1.21	0.01
C D (P= 0.05)	NS	NS	1.19	27.88	NS	2.58	NS
Spacing (S)							
S1 (75×25 cm)	90.22 (71.88)	24.16	48.81	63.33	2179.72	8300.24	0.15
S2 (60×25 cm)	88.44 (70.21)	22.93	47.28	75.55	2027.93	6721.44	0.17
S3 (50×25 cm)	87.22 (69.32)	20.37	44.8	92.22	1776.67	5494.86	0.18
SEm±	1.48	1.22	0.56	9.51	114.77	1.21	0.01
C D (P= 0.05)	NS	NS	NS	NS	NS	NS	NS
Interactions (D×S)							
SEm±	2.56	2.12	0.97	16.48	198.78	2.07	0.01
C D (P= 0.05)	NS	NS	NS	NS	NS	NS	NS

* Transformed values are given in parenthesis.

maximum seed yield per hactare was recorded in S3 (50×25cm, 1066.66kg) and minimum in S1 (75×25cm, 850.68). Significantly higher seed yield per hectare in closer spacing have been reported by several workers i.e., Sonu et al. (2013), Pandey et al. (2012), Moniruzzaman et al. (2008) and Soni et al. (2013).

Effect of sowing time and spacing on seed quality attributes: 1000 seed weight was significantly higher in D1 (15th June, 47.26g) followed by D2 (30th June, 44.68g) with minimum in D3 (15th July, 38.96), presented in Table 4, is attributed to more assimilation of food reserves in seed and the results are in agreement with Sharma et al. (2014), Sonu et al. (2013) Dhankhar et al. (2011) and Dhankhar et al. (2009). The percent germination, seedling length, seed vigour index-I and electrical conductivity could not be influenced by date of sowing. However, seedling dry weight and seed vigour index II had shown significant difference for date of sowing. The seedling dry weight (97.00 mg) and seed vigour index II (8794.99) were significantly higher in D1 (15th June). Seed quality characters, like percent germination, seedling length, seedling dry weight, seed vigour index I, seed vigour index II and electrical conductivity were not affected by spacing. The percent germination was not affected by plant spacing in this experiment and the results are confirmation with Moniruzzaman et al. (2008) in okra. Similarly seedling length was also not affected by the plant spacing and the results were in agreement with Sonu et al. (2013).

Conclusion

Based upon the results recorded in this study, it is concluded that in order to obtained higher seed yield and quality seed, the seed crop of okra cv. Pusa Bhindi -5 should be sown between 15-30 June with the spacing of 50×25 cm under Delhi conditions.

Lkkjka'k

वर्तमान अनुसंधान भिण्डी की किस्म पूसा भिण्डी–5 की बुवाई के समय एवं पौध अंतरण का बीज उपज एवं गुणवत्ता पर प्रभाव को ज्ञात करने के लिए अनुसंधान प्रक्षेत्र, शाकीय विज्ञान संभाग, भा.कृ.अनु.प.–भारतीय कृषि अनुसंधान संस्थान, पूसा, नई दिल्ली में वर्ष 2017 (खरीफ) के दौरान किया गया एवं बीज गुणवत्ता लक्षणों की जांच बीज विज्ञान एवं प्रौद्योगिकी संभाग की बीज परीक्षण प्रयोगशाला में किया गया। इस अनुसंधान कार्य में बुवाई की तीन तिथियाँ क्रमशः डी.–1(15 जून), डी.–2 (30 जून), डी.–3 (15 जुलाई) तथा तीन पौध अंतरण क्रमशः 75 x 25 सेमी. (एस.–1), 60 x 25 सेमी. (एस.–2) एवं 50 x 25 सेमी. (एस.–3) निर्धारित की गयी जिसका उद्देश्य बुवाई के समय एवं पौध अंतरण का बीज उपज एवं गुणवत्ता कारकों पर प्रभाव देखना था। यह परीक्षण कार्यक्रम यादृच्छिक प्रखण्ड विन्यास में चार बार प्रतिकृति पर किया गया और अध्ययन के अनुसार विभिन्न मात्रात्मक एवं गुणात्मक लक्षणों को मापा गया तथा उसका उपयुक्त सांख्यिकीय विधि अपनाकर विभिन्नता का विश्लेषण किया गया। बुवाई का समय एवं दूरी का सार्थक प्रभाव पौध की ऊँचाई एवं पत्तियों की संख्या पर बुवाई के 30, 45 व 60 दिनों उपरान्त पायी गयी। बीज की बुवाई का सार्थक प्रभाव प्रथम पुष्पन के दिनों, प्रति पौध फलियों की संख्या, प्रति पौध बीज उपज, बीज उपज प्रति हेक्टेयर तथा 1000 बीज भार पर पाया गया। इस अनुसंधान कार्य के परिणामों को ध्यान में रखते हुए संस्तुत की जाती है कि भिण्डी की किस्म पूसा भिण्डी–5 से अधिक बीज उपज एवं उच्च बीज गुणवत्ता प्राप्त करने के लिए बीज फसल की बुवाई 15 जून को 50 x 25 सेमी. फसल अंतरण अपनाकर प्राप्त किया जा सकता है।

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