

Effect of Apical Pinching and Growth Retardants on Seed Quality Parameters of Okra (*Abelmoschus esculentus* (L.) Moench.) cv. GO-6

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ABSTRACT: The investigation was undertaken at the *Sagdividi* Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh, during *kharif* 2021 to study the effect of apical pinching and growth retardants on seed quality parameter of okra (*Abelmoschus esculentus* (L.) Moench.) cv. GO-6. Based on overall results, it was found that apical pinching and growth retardant played an important role on seed quality parameters of okra. Pinching at 20 DAS (P1) was found effective in improving quality of seeds of okra. The maximum improvement was observed for all the seed quality parameters except hundred seed weight and seed diameter with application of KH_2PO_4 @ 5000 ppm.

Keywords: Apical pinching, growth retardant, okra, seed quality

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench), also known as ladies' finger or bhindi (in India), is an economically important annual vegetable crop grown in tropical and subtropical parts of the world. In India, it is grown for tender fruits, which are used as vegetable. Okra is member of "*Malvaceae*" family with $2n=8x=72$ or 144 chromosome and is polypoidy in nature and genus is "*Abelmoschus*". Okra is native of South Africa and Asia.

Among several seed production approaches, apical pinching, which is known to alter the source-sink relationship by arresting the vegetative growth and hastening the reproductive phase, is used in several species to increase seed yield and improve quality. It also helps in production of more pod bearing branches with luxuriant foliage, thus resulting in increased photosynthetic metabolic, accumulation of more photosynthates and metabolites, ultimately resulting in better seed quality with higher seed yield.

Plant growth regulators are chemical compounds applied in very small amounts, having unique metabolism and properties to affect physiological processes like stimulating or inhibiting the growth of plants by modifying natural hormonal action [1]. The growth regulators include both growth promoters and growth retardants, which

modify the canopy structure and yield [2]. These chemicals, that occur either naturally or applied in synthetic form, affect the growth and development of plants by changing the endogenous level of natural hormones. Further in this category, growth retardants are a diverse group of synthetic compounds that inhibit the cell division in the sub apical meristem of the shoot resulting in reduced stem elongation. These growth retarding chemicals modify the canopy structure and yield ultimately by slowing down the cell division and cell elongation in shoot tissue and regulate the plant height physiologically without any adverse effect on the rate of development and vigor of the plant [3]. Thus, for obtaining higher seed yield, with good seed quality, stage of application of plant growth regulators has to be planned carefully [4].

MATERIALS AND METHODS

The experiment was conducted at *Sagdividi* farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif* 2021 to study the effect of apical pinching and growth retardants on seed yield parameter of okra (*Abelmoschus esculentus* (L.) Moench.) cv. GO-6. The experiment was laid down in Randomized Block Design (Factorial) with three levels of apical pinching and 13

different treatments of application of growth retardants. The observation on seed quality parameters were recorded viz., hundred seed weight, seed diameter (mm), germination (%), seedling length (cm), seedling dry weight (mg), seedling vigour index-I (length) and seedling vigour index-II (mass) under laboratory experiments as per the treatment combinations evaluated in the field immediately after harvest.

RESULTS AND DISCUSSION

Effect of apical pinching on seed quality parameters

Irrespective of growth retardant treatments, all the seed quality parameters differed significantly due to apical pinching except germination.

100 seed weight was significantly high in P1 (6.40 g) which was at par with P2 (6.25 g) and P0 (6.23 g). Significantly higher seed diameter was observed in P1(4.64 mm) which was at par with P2 (4.57 mm). The lowest was recorded in P0 (4.50 mm). Comparatively the maximum germination percentage (88.38%) was recorded at pinching at 20DAS (P1) and the minimum germination percentage (87.47%) in control. Significantly higher seedling dry weight was observed in P1(21.35 mg) which significantly differed with P0(20.06mg). The lowest was recorded in P2(20.21mg). Significantly higher seedling length was observed in P1(20.61 mm) which differed with P2(19.59 mm). The lowest was recorded in P0(19.49 mm). Significantly higher vigour index 'I' was observed in P1(1825.93) which significantly differed with P2(1718.84). The lowest was recorded in P0(1717.78). Significantly higher vigour indexa! was observed in P1(1888.58) which significantly differed with P2(1777.45). The lowest was recorded in P0(1758.34)(Table 1 and 2). The present finding was in agreement with those reported by Bhat (1994), Gujar and Srivastava (1972) and Sajjan *et al.* (2004). The higher seed quality parameters noticed with pinching at proper stage may be due to increase in photosynthetic area leading to higher photosynthetic rate, better assimilation and accumulation of more photosynthates resulting in better seed development.

Effects of growth retardants on seed quality parameters

Irrespective of apical pinching, all the seed quality parameters differed significantly due to growth retardant treatments. KH_2PO_4 is important for cell division and development of new tissues. Phosphorus is also associated with complex energy transformation in plant.

Adding KH_2PO_4 for foliar spray and soaking treatment for promotes the root growth and hardness of plant and often hastens maturity.

Significantly higher hundred seed weight was recorded at CCC 200 ppm (T3) (7.23 g), which was followed by KH_2PO_4 5000 ppm (T9)(6.71 g) and differed significantly with rest of the treatments. The lowest was noticed in control T0(5.44 g). Significantly more seed diameter was recorded at CCC 200 ppm (T3) (4.82 mm), which was on par with KH_2PO_4 5000 ppm (T9)(4.68 mm) and differed significantly with rest of the treatments. The lowest was noticed in control T0 (4.24 mm). Significantly more germination percentage was recorded at KH_2PO_4 5000 ppm (90.78%) followed by KH_2PO_4 10,000 ppm (88.94%), CCC 200 ppm (87.19%). Potassium dihydrogen phosphate helps in quick seed germination and thus results in more vegetative growth and this may be due to 'K' element being more permeable through seed coat in okra. The lowest seed germination per cent was seen in control T0 (85.72%). Significantly more seedling length was recorded at KH_2PO_4 5000ppm (T9) (22.90), which was followed by CCC 200 ppm (T3) (19.16) and differed significantly with rest of the treatments. The lowest was noticed in control T0(16.47). Significantly more seedling dry weight was recorded at KH_2PO_4 5000 ppm (T9) (24.19 mg), which was followed by CCC 200 ppm (T3) (19.56 mg) and differed significantly with rest of the treatments. The lowest was noticed in control T0 (17.77 mg). Significantly more seedling vigour index I was recorded at KH_2PO_4 5000 ppm (T9) (2078.90), which was followed by KH_2PO_4 10,000 ppm (T12) (1878.76) and CCC 200ppm T3) (1671.65)and differed significantly with rest of the treatments. The lowest was noticed in control T0 (1412.69). Significantly more vigour index a! recorded at KH_2PO_4 5000 ppm (T9) (2196.51), which was followed by KH_2PO_4 10,000 ppm (T12) (1876.74) and CCC 200 ppm (T3) (1704.14) and differed significantly with rest of the treatments (Table 1 and 2). The lowest was noticed in control T0(1523.92). Similar observations were made by [5,6,7,8].

Interaction effect of apical pinching × growth retardants on seed quality parameters

Interaction effect between apical pinching and growth retardant was found to differ significantly for seed quality parameters. The result on hundred seed weight and seed diameter showed non-significant difference due to interaction of apical pinching and growth retardant. Maximum hundred seed weight and seed diameter was

Table 1. Effect of apical pinching and growth retardants on hundred seed weight (g), seed diameter (mm) and germination (%) in okra

Treatments		Hundred seed weight (g)	Seed diameter (mm)	Germination (%)
Apical pinching				
P0-	Without pinching	6.23	4.50	87.47
P1-	Apicalpinchingat20 DAS	6.40	4.64	88.38
P2-	Apicalpinchingat30 DAS	6.25	4.57	87.95
	S.Em.±	0.04	0.03	0.46
	C.D.at 5%	0.12	0.09	NS
Growth retardants				
T0-	Control (unsprayed)	5.44	4.24	85.72
T1-	Soaking of seeds in cycocel 200 ppm before sowing for16hours	7.19	4.80	86.83
T2-	Foliarapplicationincycocel200ppmat 30 DAS	6.94	4.77	87.14
T3-	T1+T2	7.23	4.82	87.19
T4-	Soaking of seeds in cycocel 400 ppm before sowing for16hours	5.60	4.48	86.16
T5-	Foliarapplicationincycocel400ppmat 30 DAS	6.00	4.45	86.18
T6-	T3+T4	5.95	4.43	86.21
T7-	Soaking of seeds in KH_2PO_4 5000 ppm before sowing for16 hours	6.60	4.68	90.26
T8-	Foliarapplicationin KH_2PO_4 5000 ppm at 30 DAS	6.51	4.66	90.42
T9-	T7+T8	6.71	4.68	90.78
T10-	Soaking of seedsin KH_2PO_4 10,000 ppm before sowing for16 hours	5.93	4.50	88.59
T11-	Foliarapplicationin KH_2PO_4 10,000 ppm at 30 DAS	6.11	4.48	88.74
T12-	T10+T11	5.62	4.47	88.94
	S.Em.±	0.09	0.06	0.96
	C.D.at 5%	0.25	0.18	2.70
P×T				
	P0× T0	5.41	4.15	85.15
	P0× T1	7.16	4.74	86.38
	P0× T2	7.10	4.72	86.48
	P0× T3	7.13	4.74	86.52
	P0× T4	5.50	4.41	0.00
	P0× T5	6.17	4.41	86.06
	P0× T6	6.00	4.40	86.12
	P0×T7	6.33	4.63	89.70
	P0×T8	6.25	4.63	89.74
	P0×T9	6.50	4.62	90.12
	P ₀ ×T ₁₀	5.83	4.39	88.08
	P ₀ ×T ₁₁	6.00	4.34	88.20
	P ₀ ×T ₁₂	5.67	4.34	88.37
	P1×T0	5.50	4.31	86.02
	P1×T1	7.13	4.91	87.52
	P1×T2	7.30	4.85	87.56
	P1× T3	7.33	4.97	87.59
	P1×T4	5.58	4.48	86.26
	P1×T5	6.07	4.47	86.29
	P1×T6	6.12	4.47	86.30
	P1×T7	6.83	4.72	90.74
	P1×T8	6.70	4.69	91.00
	P1× T9	6.97	4.72	91.50
	P1× T10	5.94	4.60	89.26
	P1× T11	6.17	4.59	89.44
	P1× T12	5.51	4.58	89.50
	P2×T0	5.43	4.25	86.01
	P2×T1	7.28	4.75	86.06
	P2×T2	7.20	4.74	86.12
	P2×T3	7.24	4.76	86.16
	P2×T4	5.73	4.54	86.26
	P2×T5	5.76	4.46	86.29
	P2×T6	5.72	4.42	86.30
	P2×T7	6.63	4.69	90.33
	P2×T8	6.57	4.64	90.52
	P2×T9	6.67	4.69	90.73
	P2×T10	6.00	4.52	88.43
	P2×T11	6.17	4.51	88.46
	P2×T12	5.67	4.48	88.93
	Mean	6.31	4.57	85.73
	S.Em.±	0.16	0.11	1.66
	C.D. at 5%	NS	NS	NS
	C. V%	4.31	4.2	3.27

Table 2. Effect of apical pinching and growth retardants on seedling length (cm), seedling dry weight (g), seedling vigour index I (length) and seedling vigour index II (mass) in okra

Treatments	Seedling length (cm)	Seedling dry weight (mg)	Seedling vigour index I (length)	Seedling vigour index II (mass)
Apical Pinching				
P0- Without pinching	19.49	20.06	1717.78	1758.34
P1- Apicalpinchingat 20DAS	20.61	21.35	1825.93	1888.58
P2- Apicalpinchingat30DAS	19.59	20.21	1718.84	1777.45
S.Em.±	0.12	0.10	12.41	14.64
C.D.at 5%	0.34	0.28	34.94	41.23
Growth Retardants				
T0- Control (unsprayed)	16.47	17.77	1412.69	1523.92
T1- Soaking of seeds in cycocel 200 ppm before sowing for 16 hours	18.84	19.29	1634.80	1673.11
T2- Foliar application in cycocel 200 ppm at 30DAS	19.05	19.41	1669.68	1678.35
T3- T1+T2	19.16	19.56	1671.65	1704.14
T4- Soaking of seeds in Cycocel 400 ppm before sowing for 16 hours	17.78	18.65	1532.77	1608.54
T5- Foliar application in Cycocel 400 ppm at 30 DAS	18.19	18.88	1570.20	1629.94
T6- T3+T4	18.43	19.04	1590.13	1633.49
T7- Soaking of seeds in KH ₂ PO ₄ 5000 ppm before sowing for 16 hours	22.18	23.40	2002.90	2111.96
T8- Foliar application in KH ₂ PO ₄ 5000 ppm at 30 DAS	22.67	23.87	2050.03	2157.98
T9- T7+T8	22.90	24.19	2078.90	2196.51
T10- Soaking of seeds in KH ₂ PO ₄ 10,000 ppm before sowing for 16 hours	20.89	20.88	1850.72	1850.06
T11- Foliar application in KH ₂ PO ₄ 10,000 ppm at 30 DAS	20.98	20.97	1861.13	1860.83
T12- T10+T11	21.13	21.10	1878.76	1876.74
S.Em.±	0.25	0.21	25.83	30.48
C.D.at 5%	0.70	0.59	72.73	85.82
P×T				
P0× T0	16.54	17.50	1422.61	1490.07
P0×T1	17.35	19.65	1500.93	1697.41
P0×T2	17.45	19.78	1516.63	1690.18
P0×T3	17.50	19.97	1546.25	1742.62
P0×T4	18.00	18.01	1548.53	1550.08
P0×T5	18.01	18.36	1552.59	1582.43
P0×T6	18.11	18.46	1562.27	1590.82
P0×T7	22.05	22.08	1990.74	1986.68
P0×T8	22.64	22.19	2044.85	1999.96
P0×T9	22.85	22.73	2069.23	2056.16
P0×T10	20.94	20.55	1847.85	1809.58
P0×T11	21.00	20.63	1854.25	1819.10
P0×T12	21.12	20.87	1874.40	1843.34
P1×T0	16.81	18.00	1442.70	1550.76
P1×T1	19.89	20.11	1743.92	1759.62
P1×T2	20.05	20.23	1771.09	1771.45
P1×T3	20.16	20.45	1759.22	1790.89
P1×T4	18.27	19.20	1576.14	1659.95
P1×T5	18.77	19.23	1622.36	1665.66
P1×T6	19.20	19.56	1661.20	1661.77
P1×T7	22.98	25.12	2087.49	2271.41
P1×T8	23.66	25.78	2155.70	2335.16
P1× T9	23.90	26.00	2189.47	2369.10
P1× T10	21.34	21.20	1901.14	1895.06
P1× T11	21.40	21.29	1908.98	1906.63
P1× T12	21.48	21.35	1917.68	1914.10
P2×T0	16.12	17.82	1372.77	1530.94
P2×T1	19.12	18.11	1659.56	1562.30
P2×T2	19.48	18.22	1721.30	1573.42
P2×T3	19.62	18.27	1709.48	1578.92
P2×T4	17.17	18.74	1473.65	1615.59
P2×T5	17.84	19.04	1535.64	1641.74
P2×T6	17.97	19.11	1546.91	1647.90
P2×T7	21.56	23.00	1930.48	2077.80
P2×T8	21.80	23.64	1949.55	2138.83
P2×T9	22.03	23.85	1978.01	2164.26
P2×T10	20.48	20.89	1803.19	1845.55
P2×T11	20.64	21.00	1820.16	1856.77
P2×T12	20.86	21.08	1844.22	1872.79
Mean	19.90	20.54	1754.18	1808.12
S.Em.±	0.43	0.36	44.74	52.80
C.D.at 5 %	NS	1.01	NS	NS
C. V%	3.74	3.04	4.42	5.06

Table 3. List of best apical pinching, growth retardants and their interaction on seed yield quality characters

Characters	P	T	P×T
Hundred seed weight	P ₁ ; P ₂ ; P ₀	T ₃ ; T ₁	P ₁ T ₃
Seed diameter	P ₁ ; P ₂	T ₃ ; T ₁ ; T ₂ ; T ₉ ; T ₇ ; T ₈	P ₁ T ₃
Germination per cent	P ₁	T ₉ ; T ₈ ; T ₇ ; T ₁₂ ; T ₁₁ ; T ₁₀	P ₁ T ₉
Seedling dry weight	P ₁	T ₉ ; T ₈	P ₁ T ₉ ; P ₁ T ₈ ; P ₁ T ₇
Seedling length	P ₁	T ₉ ; T ₈	P ₁ T ₉
Vigour index-I	P ₁	T ₉ ; T ₈	P ₁ T ₉
Vigour index-II	P ₁	T ₉ ; T ₈ ; T ₇	P ₁ T ₉

observed in P₁T₃ (7.33 g and 4.97 mm). Maximum germination percentage, seedling length, seedling dry weight, vigour index-I and vigour index-II were observed in P₁T₉ (91.50%, 23.90 cm, 26.00 mg, 2189.47 and 2369.10), though the values were not significantly different from other treatments (Table 1 and 2).

Thus, though apical pinching and application of KH₂PO₄ and CCC independently improved seed weight and quality parameters significantly, but their interaction did not result in synergistic effect in okra.

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