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Seed Quality In Radish As Affected By Age Of Stecklings, Spacing Combinations And Plant Growth Regulators.

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Abstract

The present investigation was conducted at Division of Vegetable Science and Floriculture, SKUAST-Jammu for the two consecutive years 2013-14 and 2014-15.The investigation involved age of stecklings (70 days and 85 days old), spacing combinations (60x60 cm and 90x90 cm) and three levels of growth regulators GA_3 and NAA each with one control as water spray.The results revealed that age of stecklings (70 days old) affected number of siliqua per plant (848.24) and length of siliqua (4.45) significantly. Maximum number of siliqua per plant (861.98), number of seeds in siliqua (6.96), 1000 seed weight (13.72), seed yield per plant (59.19), seed vigour index *in vivo* (1507.22), seed vigour index *in vitro* (1531.58), seed germination percentage *in vivo* (88.83) and seed germination percentage*in vitro* (92.50) were recorded with plant regulator GA_3@ 200 ppm followed by NAA @ 100 ppm. The spacing combination of 90x90 cm resulted in maximum number of siliqua per plant (832.67), 1000 seed weight (12.51), seed vigour index *in vivo* (1436.07) and seed vigour index *in vitro* (1457.26).

Key words ;Radish, seed production, GA_3, NAA and spacing

Introduction

The worldwide production of vegetables has doubled over the past quarter century and the value of global trade in vegetables now exceeds that of cereals**.** In the past two decades, the vegetable production in India has increased 2.5 times from 58.5 mt to 162.18mt and total cultivated area under vegetables from 5.59 mhato 9.20 mha from 1991-92 to 2013-14 (Kumar *et al*. 2011, Anonymous 2013). Finally, it lead to ever increasing demand for the quality vegetable seed. Moreover, the yield of crops are higher when produced from replaced seeds than own

saved seeds. (Koundinya and Kumar2014). Total quantity of vegetable seeds produced in the country is not sufficient to meet the country's ever increasing demand. Currently demand of quality seeds are met to the extent of 20% only. Farmers themselves meet the 75% of seed demand through own saved seeds (Pooniaet *al.* 2013).

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India is still importing the vegetable seeds from other countries major being radish followed by cabbage and pea (Vanitha*et al*. 2013). There is a greater need to make available quality seeds to the farmers in time and in sufficient quantity at a reasonable price.

Amongst the production techniques, maintenance of optimum plant population per unit area and age of roots are the prime important non cash inputs for increasing the flowering, fruiting and seed yield. Plant growth regulators can improve physiological efficiency of plants including photosynthetic capacity and effective partitioning of assimilates (Solaimalai*et al*.2001). Keeping in view the importance of quality seed, an experiment was envisaged to know the effect of age of stecklings, spacing combinations and plant growth regulators on quality of radish seed.

Materials and methods

The present investigation was carried out at the experimental farm-II of Division of Vegetable science and Floriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology -Jammu during winter season of 2013-14 & 2014-15. The treatments consisted of age of stecklings viz. 70 days old and 85 days old, planting spacing combinations of 60x60 cm and 90x90 cm and three concentrations viz. 100, 200 and 300 ppm each of plant regulators of GA_3 and NAA along with one control (spray with distilled water) arranged in split plot design. The variety of radish used was SJWR (CR-45). The design of experiment was split plot design with three number of replications. The number of treatments were 28.

The data on various characters such number of primary branches,number of siliqua per plant, length of siliqua per plant, number of seeds per siliqua, 1000 seed weight, seed yield per plant, seed vigour index *in vivo* and *in vitro*, seed germination percentage in *vivo* and *in vitro* were recorded. The statistical analysis for each character was carried out on mean values. The data was subjected to the analysis of variance as given by Panse and Sukhatme (1989) to draw statistical inferences. To judge the difference between the means of any two treatments, critical difference at 5% level was worked out. Biometrical data for all the parameters was put to statistical analysis by using OPSTAT software.

Results and Discussion

The pooled data for two years for the main effects of age of stecklings, spacing combinations and plant growth regulators on number of siliqua per plant, length of siliqua and number of seeds per siliqua is discussed in Table no.1

Table no. 1 : Effect of age of stecklings, spacing combinations and plant growth regulators on number of siliqua per plant, on length of siliqua and number of seeds per siliqua.

Treatments	Number of siliqua per plant	Length of siliqua per plant	Number of seeds per siliqua
Age of stecklings			
A1 : 70 Days Old	848.24	4.45	6.64
A2 : 85 Days Old	813.97	4.25	6.49
S.E (m)±	2.31	0.32	0.02
CD at 5%	14.29	0.19	N.S
Spacing combinations			
S1 : 60x60 cm	829.53	4.33	6.60
S_2 : 90x90 cm	832.67	4.37	6.53
S.E (m)±	5.20	0.03	0.03
CD at 5%	14.18	N.S	N.S
Plant Growth regulators			
G0 : water spray	768.90	4.02	6.00
G1 : 100 ppm GA_3	832.61	4.20	6.65
G2 : 200 ppm GA_3	861.98	4.45	6.96
G3 : 300 ppm GA_3	837.10	4.38	6.53
G4 : 100 ppm NAA	857.34	4.59	6.70
G5 : 200 ppm NA	827.41	4.44	6.62
G6 : 300 ppm NAA	832.39	4.30	6.50
S.E (m)±	9.74	0.05	0.05
CD at 5%	27.65	0.16	0.16

Perusal of data in tableno. 1 revealed that the age of stecklings significantly affected the number of siliqua per plant and length of siliqua. The maximum number of siliqua per plant (848.24) were recorded with A1 (70 days old stecklings) and minimum (813.97) were obtained with A2 (85 days old stecklings). Similarly, the maximum length of siliqua per plant (4.45) was recorded with A1 (70 days old stecklings) and minimum (4.25) with A2 (85 days old stecklings). However, they did not affect number of seeds in siliqua. This might be due to congenial agroclimatic conditions and physiological stage of steckling that helped in quick establishment of steckling and better growth of plants in early stage.The maximum number of siliqua per plant (832.67) was observed at 90x90 spacing combination. The higher number of silique per plant may be attributed to availability of more space, light, food material from soil and their effective distribution to the plants. The results are in close line with the findings ofSharma and Lal (1991), Bilekudari*et al.* (2005) and Kumar *et al.* (2012) in radish.

As regards the plant growth regulators, the maximum number of siliqua per plant (861.98) and number of seeds in siliqua (6.96) were observed with GA_3 @ 200 ppm. The reason behind this may be interpreted to the physiological role of gibberellins and auxins in increasing cell division, elongation and stimulating the complete growth of plant which reflected in better pod setting by using GA_3 and NAA.

As regards the interactions, the treatment combination of 70 days old steckling at 90x90 cm spacing combination and 70 days old stecklings with spray of GA_3 @ 200 ppm were the best in producing the highest number of siliqua per plant (858.41) and (876.10) respectively.

Table no. 2 : Effect of age of stecklings, spacing combinations and plant growth regulators on 1000 seed weight, seed yield per plant and seed germination percentage*in vivo*.

Treatments	1000 seed weight	Seed yield per plant	Seed germination percentage *in vivo*
Age of stecklings			
A1 : 70 Days Old	12.34	54.82	85.95 (9.32)
A2 : 85 Days Old	12.38	54.50	86.35 (9.34)
S.E (m)±	0.09	0.12	0.13
CD at 5%	N.S	N.S	N.S
Spacing combinations			
S1 : 60x60 cm	12.21	54.09	86.26 (9.34)
S_2 : 90x90 cm	12.51	55.23	86.04 (9.32)
S.E (m)±	0.06	0.25	0.25
CD at 5%	0.17	0.72	N.S
Plant Growth regulators			
G0 : water spray	10.67	43.24	81.83 (9.10)
G1 : 100 ppm GA_3	12.49	53.45	85.33 (9.29)
G2 : 200 ppm GA_3	13.72	59.19	88.83 (9.47)
G3 : 300 ppm GA_3	12.52	56.58	86.41 (9.34)
G4 : 100 ppm NAA	13.07	58.28	88.00 (9.43)
G5 : 200 ppm NA	12.10	56.00	86.16 (9.33)
G6 : 300 ppm NAA	11.96	55.90	86.50 (9.35)
S.E (m)±	0.11	0.47	0.46
CD at 5%	0.33	1.35	1.44

(Note; The values in parenthesis are the transformed values)

The pooled data in table no. 2 exhibited non-significant differences among different age of stecklings. The data revealed that the maximum 1000 seed weight (12.51) was recorded with treatment S2 (90x90 cm spacing combination) and minimum (12.21) with treatment (60x60 cm). The seed yield per plant (55.23) obtained at 90x90 cm spacing combination was higher than that (54.09) obtained at 60x60 cm. This might be due to more leaf area for photosynthesis and the efficient utilization of these photosynthates from source (leaves) to sink (reproductive parts) might have enhanced the better filling of seeds, more number of pods, thus resulting in increased seed weight in plants grown on wider spacings.The results are in conformity to the findings of Warade*et al.* (2004) and Bilekudari*et al.* (2005). As regards to plant growth regulators, the treatment G2 (200 ppm GA_3) showed maximum 1000 seed weight (13.72) and the minimum (10.67) was recorded when sprayed with water. This might be due to effect of GA_3 and NAA which increased the permeability of the cell wall which allow greater amount of water and dissolved materials to enter the cell and this would have increased weight of seeds which reflected on greatest 1000 seed weight.Shahid*et al*. (2013) also observed the similar results with use of GA_3 and NAA in Okra.The maximum seed yield per plant (59.19) and seed germination percentage (88.83) were recorded with GA_3 @ 200 ppm followed by spray of NAA @ 100 ppm.

Table no. 3 : Effect of age of stecklings, spacing combinations and plant growth regulators on seed germination percentage*in vitro*, seed vigour index *in vivo* and seed vigour index *in vitro*

Treatments	**Seed germination percentage*in vitro***	**Seedvigour index *in vivo***	**Seed vigour index *in vitro***
Age of stecklings			
A1 : 70 Days Old	88.83 (12.34)	1439.10	1460.69
A2 : 85 Days Old	88.16 (12.38)	1399.33	1418.65
S.E (m)±	0.09	8.84	6.99
CD at 5%	N.S	N.S	N.S
Spacing combinations			
S1 : 60x60 cm	88.40 (12.21)	1402.36	1422.08
S_2 : 90x90 cm	88.59 (12.51)	1436.07	1457.26
S.E (m)±	0.06	5.65	4.68
CD at 5%	0.17	16.04	13.29
Plant Growth regulators			
G0 : water spray	83.41 (10.67)	1254.56	1273.32
G1 : 100 ppm GA_3	88.00 (12.49)	1427.38	1461.39
G2 : 200 ppm GA_3	92.50 (13.72)	1507.22	1531.58
G3 : 300 ppm GA_3	89.50 (12.52)	1461.15	1483.00
G4 : 100 ppm NAA	90.41 (13.07)	1477.44	1492.65
G5 : 200 ppm NAA	88.66 (12.10)	1423.27	1437.67
G6 : 300 ppm NAA	87.00 (11.96)	1383.50	1398.11
S.E (m)±	0.11	10.57	8.76
CD at 5%	0.33	30.01	24.87

(Note; The values in parenthesis are the transformed values)

The results in Table no. 3revealed that there was no significant variation with respect to seed germination percentage (*in vitro*), seed vigour index *in vivo* and seed vigour index *in vitro* with different age of stecklings and different spacing combinations. The seed vigour index (*in vivo*) (1436.07) and seed vigour index (*in vitro*) (1457.26) were higher at 90x90 cm spacing combination as compared to those (1402.36) and (1422.08) at 60x60 cm spacing combination. There was no significant variation with respect to seed germination percentage (*in vitro*) with different spacing combinations. This might be attributed to the fact that under wider spacing, availability of more light, nutrition, and good vegetative growth might have ultimately resulted in significantly higher test weight and vigorous seeds as compared to closer spacing. Malik*etal.* (1999) and Bilekudari*et al.*(2005) have reported similar findings. Apart from plant spacings, the plant growth regulators significantly affected the seed germination percentage *invitro*, seed vigour index *invivo* and seed vigour index *invitro*. The treatment 200 ppm GA_3 showed maximum value (92.50) for seed germination percentage (*in vitro*) followed by treatment 100 ppm NAA. The highest seed vigour index *invivo* (1507.22) and *invitro* (1531.58) were obtained with 200 ppm GA_3 treatment whereas the lowest seed vigour index *invivo* and *invitro* (1254.56) and (1273.32) were recorded in control. This is mainly due to GA_3 application which brings about metabolic changes that affect the both quality and quantity of the desired product. It also stimulates synthesis of hydrolytic enzymes which are secreted and act as starchy endosperm in turn affecting physiology of seed germination and seedling vigour. Similar effects of GA_3 on seed germination and vigour was also reported by Bhat and Singh (1996). Increase in germination percentage may be because of bolder seeds that contain greater metabolites for resumption of embryonic growth during germination. In addition to these metabolites, release of certain enzymes responsible for degradation of macromoleculesinto micromolecules within the seed. The increase in seed quality parameters due to certain changes in metabolism during seed development due to which there would be greater accumulation of food reserves resulting in higher seed quality. Similar findings have been reported by Shahid*et al*. (2013).

The interaction between age of stecklings, spacing combinations and plant growth regulators (AxSxG) was also found significant.The treatment combination A1S2G2 (70 days old stecklings, 90x90 cm spacing combination and 200 ppm GA_3) recorded the highest seed vigour index (*in vitro*) (1593.20) whereas the treatment combination A2S2G0 (85 days old stecklings, 90x90cm spacing combination with water spray) recorded the lowest value (1231.80).

References

1. **Anonymous 2013**. Area, production and productivity of fruits and vegetables in different states of the country. National Horticulture Production Database- 2012-13, MoA, GoI.
2. **Bhat K. L.and Singh A. K. 1996.** Uptake,seed germination and vigour as affected by GA_3, phosphorus and picking in seed crop of okra. *Vegetable Science.* **23** : 21-25
3. **Bilekudari M.K., Despande V.K. and Shekhargouda M. 2005.** Effect of spacing and fertilizer levels on growth, seed yield & quality of radish .*Karnataka Journal of Agricultural Science***18**: 145-7.
4. **Kumar M., Kumar S., Kumar P., Rathore S.V.S, Singh R.N. and Singh S.K. 2012.** Effect of steckling size & spacing on growth, yield and quality of radish seed cv. PusaRashmi .*Progressive Agriculture.* **12** :194-198.
5. **Kumar B., Mistry N.C., Chander, B.S.and Gandhi P. 2011.**Indian Horticulture Production at a glance. Indian Horticulture Database-2011.National Horticulture Board, Ministry of Agriculture, Government of India, pp.1-296.
6. **Koundinya A.V.V. and Kumar P.P. 2014**. Indian vegetable seeds industry - Status and Challenges.*International Journal of Plant, Animal and Environmental Sciences.* ISSN 2231-4490, pp.62-69.
7. **Malik, Y.S., Nehra B. K. and Singh 1999.** Effect of steckling planting dates

and spacing on seed yield of radish (*Raphanussativus*L.) Cv. PusaChetki. *Vegetable Science*, **26**:149-151.

8. **Panse V.G. and Sukhatme P. V.1989**.StastisticalMethods for Ag. workers ICAR, New Delhi.
9. **Poonia T. C. 2013.**History of Seed Production and its Key Issues. *International Journal of Food, Agriculture and Veterinary Science***3:** 148-154
10. **Shahid M.R., Amjad M., Ziaf K., Jahangir S.A., Iqbal Q.and Nawaz A. 2013.**Growth, yield and seed production of okra as influenced by different growth regulators. *Pak.Journal of Agricultural Science***50** : 387-392.
11. **Sharma A.K. 2000.** Effect of nitrogen and phosphors on seed yield in radish (*Raphnussativus*L.). *Agricultural Science Digest***20**:46-49.
12. **Sharma S.K.andLal G.1991.** Effect of nitrogen fertilization, plant spacing and stecking size on certain morphological characters and seed yield in radish (*Raphanussativus*L.). *VegetableScience*, **18** : 82-87
13. **Solaimalai A., Sivakumar S., Anbumani S., Suresh T. and Arumugam K. 2001.**Role of plant growth regulators in rice production. *Agri. Rev*. **22** : 33-40
14. **VanithaS.M., Chaurasia S.N. S., Singh P.M.and Naik P.S.2013.**Vegetable Statistics. Technical Bulletin No. 51, IIVR, Varanasi, pp.1-250.
15. **Warade A.D., GongeV.S., Kulwal L.V. and Giri J. 2004.** Effect of time of planting and spacing on seed yield and quality. *Agric. Sci. Digest* **24** : 21-23