

Effect of Seed Priming on Seed Germination and Vigour in Fresh and Aged Seeds of Cucumber.

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Abstracts—Seed priming (seed invigouration) has gained a lot of importance in recent times as it emerged as a most promising area of seed quality enhancement technique. Priming is a pre-sowing treatment, that involves exposure of seeds to a low external water potential that limits hydration, (controlled hydration of seed) to a level that permits pre-germinative metabolic activity to proceed, but prevents actual emergence of the radical. Fresh seeds of cucumber was artificially aged as per ISTA standards to obtain low vigour seed lots. Both high vigour (unaged) and low vigour (aged) seeds were subjected to seed priming with various chemicals (water, KH_2PO_4 , K_2HPO_4 , oxalic acid, gibberellic acid, KNO_3 , calcium chloride, salicylic acid) and results were compared to identify the best priming treatments. Changes in physiological (per cent germination, total seedling length, total seedling dry weight, seedling vigour index I and II). In cucumber seed priming improved seed germination and vigour significantly over unprimed. The response of low vigour (aged) seeds to seed priming was much higher when compared to high vigour (unaged) seeds. In cucumber, among various priming chemicals tested, seed priming with KH_2PO_4 $10^{-3}M$, K_2HPO_4 $10^{-3}M$, KNO_3 0.5% were found best as there was 8, 8 and 8 % more germination in high vigour seeds and 15, 15 & 10 % higher germination in low vigour seeds over unprimed (control). Priming with these chemicals also showed better germination per cent in both high and low vigour seeds, over hydropriming, in both the crops. Besides germination, marked increase in vigour as evident from seedling vigour index I and II was noticed due to seed priming in both the crops when compared to unprimed. In cucumber, there was 56 and 53 % higher SVI in less vigour seeds due to priming with KH_2PO_4 $10^{-3}M$ and K_2HPO_4 $10^{-3}M$, respectively, compared to unprimed, with respect to SVII, the values were 73 and 62 % more due to priming with KH_2PO_4 $10^{-3}M$ and K_2HPO_4 $10^{-3}M$, respectively, compared to unprimed in cucumber. Priming with chemicals appears beneficial as there was high per cent

vigour when compared to priming with water (hydropriming). In cucumber, priming with KH_2PO_4 $10^{-3}M$ increased SVI by 39 and 36.7 % and SVII by 35 and 26.6 % over hydropriming.

Keywords:—seed quality, priming, hydropriming, seed ageing.

I. INTRODUCTION

Today's competitive agricultural development environment demands that growers produce high yield of good quality seeds to meet the market demand. In this scenario vegetables play a vital role in the health and nutritional security of human beings in addition to improve the economy of the farmers. Although India is the second largest producer of vegetables in the world next to China, the productivity is very less (<14 t/ha). Hence, there is a great need to enhance the productivity of vegetables gradually to boost up the production. The present seed requirement under vegetables crops is estimated to be 49.1 thousand tones. In crop production, stand establishment determines plant density, uniformity, and management options. For expensive hybrid vegetable seeds, it is particularly important that seeds germinate rapidly and uniformly, tolerate adverse germination conditions, and produce normal seedlings. Seed vigor has been proved to be the primary factor governing seed quality, in the context of successful stand establishment. Hence seed invigouration/enhancement of seed vigor has been a major area of interest for researchers, owing to its high industrial and economical implications. Seed invigouration is a post harvest, pre-sowing technique for improvement of seedling emergence and stand establishment. The most promising invigouration technique for improving the rate and uniformity of plant stand is seed priming. Priming has practical implications in improving performance of vegetable crops under stressed environmental conditions such as salinity, drought, low and higher temperature (M. Piri 2009). Poor quality seeds

generally show decline in their ability to germinate and emerge into vigorous seedlings, leading to problems for successful crop production. Seed priming is a pre-sowing treatment that involves controlled hydration of seeds, sufficient to allow pre germinative metabolic events to take place and to restrict radical protrusion through the seed coat (Heydecker *et al.*, 1973). This technique has been used in some vegetables seeds including cucumber to augment the germination rate, total germination and seedling uniformity etc., mainly under unfavorable environmental conditions. It is a useful technique to exploit seed potential in arid and desert ecosystem. Also the knowledge gained on the repair mechanisms that take place upon various priming treatments has been used in many crops of seed industry. Hydro priming is nothing but soaking seeds in water for a precise time followed by re-drying. Osmopriming involves soaking seeds in aerated water potential of different osmotica (Polyethylene glycol, mannitol, sorbitol, glycerol, etc.) to control the amount of water imbibed by seeds. Chemopriming is soaking seeds in various inorganic salt solutions like KCl, KNO₃, CaCl₂, KH₂PO₄, etc. the objectives of this research is To identify suitable priming chemicals for enhancement of vigour in cucumber. and the objective of this project is to identify suitable priming chemicals for enhancement of vigour in cucumber.

II. MATERIAL AND METHODS

The present investigation on seed invigouration aspects of cucumber was conducted in the Section of Seed Science and Technology, Indian Institute of Horticultural Research, Hesaraghatta, Bangalore- 560089. The details of the materials used and methods adopted for the conduct of various experiments on seed invigouration are described hereunder:

Source of seeds

Freshly harvested and graded tomato seeds of cv. Arka meghali were obtained from the seed production unit of IIHR, Hesaraghatta, Bangalore and cucumber seeds of cv. Green long were obtained from the seed market, Avenue Road, Bangalore.

Fresh cucumber (> 95% germination) seeds was subjected to accelerated ageing as per ISTA procedure to obtain low vigour (< 60 % germination) seed lot for use in the experiment. These low and high vigour seeds were subjected to different invigouration treatments to standardize suitable chemicals. Among these treatments, best treatments were identified for further in-depth study to

know the physiological changes in relation to seed quality enhancement in cucumber.

Treatment details

Vigour levels (V) : V1- Fresh seeds - high vigour (>87 %)

V2- low vigour (<50%)

Socking time:- 24 hours(tomato), 48 hours(cucumber)

Soaking temperature (T): Ambient (28±1°C)

Treatments:

T₁- Control, T₂ Hydro priming, T₃-CaCl₂ (0.001M), T₄- Oxalic acid (0.01M), T₅ - GA₃ (500 ppm), T₆- KNO₃(0.5%), T₇-K₂HPO₄ (0.001M) T₈- KH₂PO₄ (0.001M), T₉ -SALYCILIC ACID (0.5%)

Total treatment combinations: = 9

Replications: 4

Observations recorded

The different observations recorded were

- I. Final count germination (%)
- II. Total seedling length (cm)
- III. Total seedling dry weight (mg)
- IV. Seedling vigour index –I (Germination percentage X Seedling length)
- V. Seedling vigour index –II (Germination percentage X Seedling dry weight)

III. RESULT & DISCUSSION

In cucumber seed priming improved seed germination and vigour significantly over unprimed. The response of low vigour (aged) seeds to seed priming was much higher when compared to high vigour (unaged) seeds. In cucumber, among various priming chemicals tested, seed priming with KH₂PO₄ 10⁻³M, K₂HPO₄10⁻³ M, KNO₃ 0.5% were found best as there was 8, 8 and 8 % more germination in high vigour seeds and 15, 15 & 10 % higher germination in low vigour seeds over unprimed (control). Priming with these chemicals also showed better germination per cent in both high and low vigour seeds, over hydropriming, in the crops. Besides germination, marked increase in vigour as evident from seedling vigour index I and II was noticed due to seed priming in both the crops when compared to unprimed. In cucumber, there was 56 and 53 % higher SVI in less vigour seeds due to priming with KH₂PO₄ 10⁻³ M and K₂HPO₄10⁻³ M respectively, compared to unprimed. Similarly, with respect to SVII, the values were 73 and 62 % more due to priming with KH₂PO₄ 10⁻³ M and K₂HPO₄10⁻³M, respectively, compared to un-primed in cucumber. Priming with chemicals appears beneficial as there was high per cent vigour when compared to priming with water (hydropriming). In cucumber, priming with KH₂PO₄ 10⁻³ M

increased SVI by 39 and 36.7 % and SVII by 35 and 26.6 % over hydropriming. (Table 1).

IV. CONCLUSION

Fresh seeds of cucumber was artificially aged as per ISTA standards to obtain low vigour seed lots. Both high vigour (unaged) and low vigour (aged) seeds were subjected to seed priming with various chemicals (water, KH_2PO_4 , K_2HPO_4 , oxalic acid, gibberellic acid, KNO_3 , calcium chloride, salicylic acid) and results were compared to

identify the best priming treatments. Changes in physiological (per cent germination, total seedling length, total seedling dry weight, seedling vigour index I and II) and biochemical parameters (Electric conductivity, total soluble sugars and proteins, dehydrogenase activity, amylase activity, catalase activity, protein profiles, isozyme profiles) in relation to enhancement in viability and vigour upon priming were identified. The germination ability of primed seeds was compared with unprimed seeds under various abiotic stress conditions.

Table.1: Effect of seed priming on seed germination and vigour in fresh and aged seeds of cucumber.

TREATMENTS	Germination Percentage		Total Seedling Length (cm)		Total Dry Weight (g)		Seedling Vigour Index I		Seedling Vigour Index II	
	Fresh	Aged	Fresh	Aged	Fresh	Aged	Fresh	Aged	Fresh	Aged
Control	87.0	50.0	29.5	25.0	0.21	0.12	2566	1250	18.27	6.00
Hydropriming	90.0	55.0	30.8	25.5	0.23	0.14	2772	1402	20.70	7.70
CaCl_2 (10^{-3})	83.0	60.0	31.7	25.9	0.23	0.14	2631	1554	19.09	8.40
Oxalic Acid (10^{-3})	82.0	46.0	31.2	27.3	0.25	0.14	2558	1255	20.50	6.44
GA3 500ppm	87.0	60.0	32.2	26.2	0.21	0.16	2801	1572	18.27	9.60
KNO_3 0.5%	95.0	55.0	29.7	28.3	0.26	0.16	2821	1556	24.70	8.80
K_2HPO_4 (10^{-3})	95.0	65.0	32.7	29.5	0.28	0.15	3106	1917	26.60	9.75
KH_2PO_4 (10^{-3})	95.0	65.0	34.2	30.0	0.28	0.16	3249	1950	26.60	10.40
Salicylic Acid 0.1%	92.0	50.0	33.2	30.0	0.20	0.13	3054	1500	18.40	6.50

CD@ 1% (means-main factor)
190 F-0.07 A-0.06

F:- 2.1 A-3.3

F-0.8 A-0.5

F-0.02 A-0.02

F-184 A-

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