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Impact of hydropriming treatments on seed invigoration in vegetable pea (*Pisum sativum* L.)

VK Sachan, Rabindra Kumar[1] and Pankaj Nautiyal

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Abstract

Various pre-sowing treatments are reported to improve seed invigoration in vegetable crops. An investigation was carried out to standardize the hydropriming techniques for vigour enhancement in vegetable pea (variety AP-3) seeds by optimizing the duration and volume of water to be used. Highest germination percentage (98), speed of germination (23.9), vigour index-I (3450) and vigour index-II (8.8) were observed when the seeds were soaked in double the volume of water for 2hrs. Increase in germination and vigour in this treatment was due to the highest initial germination, maximum dry matter production and minimum number days required for 50% germination. Hydropriming for 8,16 and 32h (prolonged soaking) resulted in lower values in almost all the parameters and it can be considered as an over priming. These studies proved the importance of duration of soaking and volume of water in pea seed invigoration.

Keywords: Hydropriming, pea and seed invigoration

Introduction

Seed vigour enhancement treatments have proven to be very effective to achieve rapid and uniform seed germination of several vegetables species (Taylor *et al*., 1998). Hydropriming is a simple, economical and eco-friendly safe type of seed priming in which seeds are soaked in water and dried before sowing to accomplish seed hydration (Soon *et al*., 2000). Though hydropriming is a simple technique, report on the benefits associated with hydro priming techniques in garden pea are limited and no comprehensive study have been made so far to find most suitable technique for vigour enhancement considering the duration of soaking and volume of water required. Hence keeping in view, the prospects of seed priming, a systematic study was attempted with different volumes of water for different durations to optimize the hydro priming treatments for enhancement of seed quality of vegetable pea.

Krishi Vigyan Kendra (ICAR - VPKAS) Chinyalisaur, Uttarkashi, Uttrakhand
[1]National Seed Corporation, Shekhpura, Raja Bazar, Patna- 14, Bihar

Materials and Methods

The study was carried in the seed testing laboratory of Krishi Vigyan Kendra (ICAR - VPKAS), Chinyalisaur, Uttarkashi, Uttrakhand, during Rabi 2007 & 2008. Seeds of vegetable pea, variety Azad Pea -3 released by C.S.A.U.A&T Kanpur (UP) was used for standardizing the hydropriming techniques. The graded pea seeds were soaked in three different volumes of water (half, equal and double the volume of seed) for five different durations of 2, 4, 8, 16, and 32h. The treated seeds were dried under ambient condition until seeds got original moisture content (Basra *et al*., 2002). The treatment effect was evaluated by testing germination percentage (ISTA 1999), speed of germination (Maguire *et al*., 1962) and determination of vigour index (Abdul *et al*., 1973). The data were subjected to CRD analysis to establish the effects of treatments over the control.

Results and Discussion

Results revealed that all studied parameters were influenced by that duration of soaking, volume of water used for soaking and their interaction. The present investigation revealed 35 per cent improvement in all germination parameters over control at 2 and 4h soaking. Hardly any of treatment of prolonged duration found significantly higher than untreated seeds. Among the quantity of water taken for soaking, half the volume of water registered higher mean values for all the parameters except days to 50 % germination and percentage of radicle protrusion where these values were found to be lower as compared to equal and double the volume of water. Germination percentage, speed of germination, vigour index-I and vigour index-II as influenced by different hydropriming treatments are presented in table 1.

Hydropriming resulted in an increase in germination from 66 (non-primed) to 98 per cent. But prolonged soaking of seeds (8h and above) resulted in a decrease in germination, lesser than control in most of the cases. Above 90 per cent could be obtained in all the volumes of water with 2h and 4h duration with maximum value (98%) in 2h soaking with double the volume of water. This was followed by 4h soaking with half and equal volume of water (96% germination) and double the volume of water (93% germination). Increase in germination was supported by the number of days taken for achieving 50 per cent germination in the present study. Fifty per cent germination was earlier (4days) in all the volumes of water at 2h and 4h soaking period whereas it took longer days in other soaking durations (Table-1).

Among the duration, the mean value for speed of germination was higher in 2h (19.9) and 4h (19.7) soaking. Considering the interaction of soaking durations and volume of water, speed of germination was significantly higher than control (13.1) in 2h and 4h soaking duration with maximum values in 2h soaking with double the volume of water (23.9) and 4h soaking with equal volume of water (23.3).

Vigour index-I increased significantly due to priming and the values were higher than control (1858) in almost all the cases except 8h soaking with equal and double the volume of water and 32h soaking with double the volume of water. Maximum vigour index-1 (3450) was observed in 2h soaking with double the volume of water followed by 4h with half (3265) and equal (3234) volume of water (table-2)

Vigour index-II was the highest (8.8) in seeds soaked in the double the volume of water for 2h whereas non-primed seeds recorded a vigour index-II of 3.25. Vigour index-II was higher than control in almost all except two treatments (8h) soaking in equal volume of water and 32h soaking in double the volume of water.

Increase in values of both the vigour indices in the present study was supported by the results of Kaur *et al*., (2002) who reported that hydroprimed gram seeds showed three fold more vigour than non-primed seeds. They also suggested that superiority of the hydropriming treatments was due to the higher activities of amylase, invertase, sucrose synthatase and sucrose phosphate synthetase in the seedlings of hydroprimed chickpea seeds. The higher amylase in the shoots of hydroprimed seedlings enhanced the rapid hydrolysis or transitory starch of the shoots leading to more availability of glucose for shoots growth and this was confirmed by the low level of starch in the shoots of primed seedlings. It is also known that priming brings the seeds to the

Table 1. Effect of hydro priming treatments on germination percentage, speed of germination and days required for 50 per cent germination.

Duration (hour)	Germination percentage					Speed of germination					Days taken to 50 % germination				
	Seed and Water ratio					Seed and Water ratio					Seed and Water ratio				
	1: 0.5	1:1	1:2	Control	Mean	1: 0.5	1:1	1:2	Control	Mean	1: 0.5	1:1	1:2	Control	Mean
2	91	91	98	66	87	21	21.6	23.9	13.1	19.9	4	4	4	5.5	4.4
4	96	96	93	66	88	19,9	23.3	22.6	13.1	19.7	4	4	4	5.5	4.4
8	76	48	56	66	62	19.7	9.8	10.8	13.1	13.4	4.5	6.0	5.6	5.5	5.4
16	78	63	66	66	68	13.4	12.4	12.7	13.1	12.9	5.0	6.0	5.5	5.5	5.5
32	81	61	63	66	68	12,9	9.8	9,9	13.1	11.4	6.0	6.0	6.0	5.5	5.9
Mean	84	72	75	66	74	17.4	15.4	16	13.1	15.5	4.7	5.2	5.0	5.5	5.1
	T	D	T x D			T	D	T x D			T	D	T x D		
CD at 5%	8.o	14.8	17.9			1.6	2.1	3.6			0.3	0.4	0.6		

T = Treatment, D=Duration

Table 2. Effect of hydro priming treatments on seed vigour index and percentage of radicle protrusion in the vegetable pea seeds

Duration (hour)	Vigour index-I					Vigour Index-II					Percentage of radicle protrusion				
	Seed and Water ratio					Seed and Water ratio					Seed and Water ratio				
	1: 0.5	1:1	1:2	Control	Mean	1: 0.5	1:1	1:2	Control	Mean	1: 0.5	1:1	1:2	Control	Mean
2	2765	3207	3450	1858	2818	6.11	5.57	8.80	3.25	5.93	0	0	0	NIL	0
4	3265	3234	2876	1858	2808	7.90	5.84	3.80	3.25	5.20	0	0	0	NIL	0
8	2009	1274	1420	1858	1640	3.94	2.05	4.13	3.25	3.34	0	0	0	NIL	0
16	2159	1975	2203	1858	2049	4.28	5.15	3.98	3.25	4.17	11	18	14	NIL	11
32	2374	2079	1808	1858	2030	5.22	4.66	3,12	3.25	4.06	9	23	21	NIL	13.5
Mean	2514	2354	2349	1858	2269	5.49	4.65	4.77	3.25	4,54	4.06	8.8	7.6	Nil	5.5
	T	D	T x D			T	D	T x D							
CD at 5%	350	452	780			1.15	1.48	2.56							

T = Treatment, D=Duration

next phase of germination by reducing the days required for germination from sowing (Caseiro *et al*., 2004).

There was no radicle protrusion in 2h, 4h and 8h soaking and beyond that, higher percentage of radicle protrusion was found with maximum values in longer soaking duration (Table 2). Higher values of 23 and 21 were recorded in 32h soaking in equal and double the volume of water respectively. It was also found that, in the present study, no treatment of prolonged duration (8,16 and 32h) performed better than untreated seeds. Ineffectiveness of this prolonged soaking may be due to the higher rate of radicle protrusion and imbibitional injury, which is directly related with rate of water imbibition regulating seed germination. Imbibitional injury was first recognized by powell and Mathews (1978) who pointed out that it was due to higher rate of water imbibition, the rapid inrush of water into embryonic cell of fast imbibing legume seeds, leading to physical disruption of the cell membrane. According to Sefa and Stanley (1979), hilum size was the most important controller of rate water imbibition in cowpea (*Vigna unguiculata)* seed and the seeds absorbed nearly 80 per cent water in the first three-hour soaking.

From this study, it was understood that both volume of water and duration of soaking is important in enhancing the vigour of pea seeds. Results clearly indicated that 2h soaking in double the volume of water is the best, giving highest percentage of germination (98%), speed of germination (23.9), vigour index-I (3450) and vigour index-II (8.8). This was due to higher initial germination, dry matter production and early attainment of 50 per cent germination. Longer hours of soaking (8h and above) resulted in lower values for all the parameters studied.

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सारांश

सब्जी फसलों में बीज ओजोस्विता वृद्धि करने के लिए अनेकों पूर्व–बुआई शोधन विवरण उपलब्ध है। हाइड्रोप्राइमिंग तकनीकी द्वारा सब्जी मटर (प्रजाति ए पी–3) के बीजों में ओज वृद्धि के लिए एक अन्वेषण किया गया जिससे अनुकूलतम समय एवं जल मात्रा का उपयोग किया जा सके। उच्चतम जमाव प्रतिशत (98), जमाव गति (23.9), ओज सूचकांक–I (3450) तथा ओज सूचकांक–II (8.8) बीजों की दुगना जल की मात्रा द्वारा 2 घण्टे तक भिगोकर परीक्षण किया गया। इस उपचार से जमाव तथा ओज की वृद्धि की हुई जो उच्च प्रारम्भिक जमाव, अधिकतम शुष्क पदार्थ उत्पादन व 50 प्रतिशत जमाव में लगे दिन द्वारा हुआ। हाइड्रोप्राइमिग के 8, 16 व 32 घण्टे (लम्बे समय तक भिगोना) उपचार के परिणाम से सभी घटकों में निम्नतम पाया गया एवं इसे अतिरेक प्राइमिग कहा जा सकता है। इस अध्ययन से मटर के बीज को भिगोकर रखने का समय एवं जल की मात्रा के महत्त्व की पुष्टि करता है।

References

Abdul-Baki AA and Anderson JD (1973) Vigour deterioration of soybean seed by multiple criteria. Crop Sci 13:630-633.

Basra SMA, Zia MN, Mehmood IA and Khaliq A (2002) Comparison of different invigoration techniques in wheat seeds. Pakistan J Arid Agri 5: 11-16.

Caseiro R, Bennett M and Filho JM (2004) Comparison of three priming techniques for onion seed lot differing in initial quality. Seed Sci Tech 11:365-375.

International Seed Testing Association (1999) International rules for seed testing. Seed Sci & Tech (Supplement rules) 27:25-30.

Kaur S, Gupta AK and Kaur N (2002) Effect of osmo and hydropriming of chickpea seeds on seedling growth and carbohydrate metabolism under water deficit stress. Plant Growth Regulation 37:17-22.

Maguire JD (1962) Speed of germination- aid in selection and evaluation for seedling emergence and vigour. Crop Sci 2: 176-177.

Powell AA and Mathews S (1978) Deteriorative changes in pea seeds stored in humid and dry conditions. J Experimental Botany 28:255-234.

Sefa DS and Stanley DW (1979) The relationship of microstructure of cowpeas to water absorption and dehulling properties. Cereal chemistry 56: 379-386.

Soon KJ, Whan CY, Gu SB, Ku AC and Lai CJ (2000) Effect of hydropriming to enhance the germination of Gourd seeds. J Korean Society Hort Sci 41: 559-564.

Taylor AG, Allen PS, Bennett MA, Bradford JK, Burris JS and Mishra MK (1998) Seed Enhancements. Seed Sci Res 8:245-256.