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Effect of Seed Soaking On Seed Germination and Growth of Bitter Gourd Cultivars

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Abstract: *In order to study the effect of seed soaking on seed germination and growth of bitter gourd cultivars an experiment was conducted at Vegetable Research Farm Singri, Bhimber Azad Kashmir, during March, 2012. Three cultivars of bitter gourd Faisalabad Long, Jaunpuri and Palee were soaked in water for various soaking durations (4, 8, 12 and 16 hours) along with control to determine the optimal soaking duration and find out the best growing cultivar. The highest germination percentage (85.18%), number of branches plant^{-1} (8.64), fruits plant^{-1} (20.70) were obtained when the bitter gourd seeds soaked for 12 hours. Earlier emergence (6.28) and earlier flowering (39.40) were recorded in plants where seeds soaked for 16 hours. Cultivar Palee significantly enhanced the germination percentage (85.56%), days to flowering (39.55), numbers of branches plant^{-1} (8.86), fruits plant^{-1} (21.09). Seed soaking in water for 12 hours has the potential to improve germination, seedling growth of bitter gourd cultivars. It was concluded that the seed soaking of cultivar Palee for 12 hours showed best results regarding maximum germination and enhanced growth under the agro-climatic conditions of district Bhimber, Azad Kashmir. Pakistan.*
Key Words: *Bitter gourd cultivars, soaking durations, germination, growth*

I. Introduction

Bitter gourd (*Momordica charantia L.*) usually called Karela or balsam pear, belongs to family Cucurbitaceae. It is one of the most important summer vegetable crop in Pakistan. It is a widespread vegetable grown in Asia and other part of the world. It is usually grown as an annual crop, but it can also perform as a perennial in mild areas and frost-free winters as well. The summer season crop is sown from January to June in the plains (Singh *et al*., 2006). Optimum temperature of 25-28 ^{0}C is required for the germination of bitter gourd seeds. (Peter *et al*., 1998). Bitter gourd has tremendous economic and dietic importance. Immature fruit is a good source of Vitamin C, and also contains Vitamin A. Bitter gourd is a blood purifier, activates spleen and liver and is highly beneficial in diabetes (Yibchok-Anun *et al*., 2006). The Bitter gourd is very much helpful in curing the diabetes. Studies have shown that bitter melon has anti-carcinogenic properties and can be used as a cytotoxic agent against many types of cancer (Grover and Yadav, 2004).

Field emergence is always a problem in bitter gourd even with the seeds of high germinability due to thick seed coat. To overcome this problem, pre-sowing treatments soaking or priming of seeds can be practiced. Pre-germinated seeds proved superior in emergence from the soil and in stand establishment. The additional advantages of this treatment include, (i) lower seed rate, (ii) dead seeds can be discarded before sowing, and (iii) germinating, but low vigor seeds can be removed before sowing. Recent studies on a series of crop species demonstrate speedy germination, early emergence, and vigorous seedlings accomplished by seed soaking in water for a while, followed by surface drying prior to sowing, which may lead to higher crop yield (Harris et al 2000). This practice of soaking is expressed that on-farm seed priming is a simple, inexpensive, and less risk process of improving faster seedling establishment and vigorous early crop growth. Each crop cultivar requires a critical soaking duration and it should be less than the safe limit (Harris *et al*., 2000). Pre-sowing seed treatments resulted in higher germination and earlier seedling emergence, strong growth, early flowering, maturity and high yields. Speedily germinating seedlings also produce deep root system and improved seedling establishment in many crops. Seed soaking is a useful to bitter gourd growers under sub-optimal temperature condition for definite successful seedling establishment (Wang *et al*., 2002 and Lin and Sung, 2001). The present research work was conducted in order to study the effect of seed soaking on the growth and yield of bitter gourd and to find out the high yielding and better-adopted bitter gourd cultivar under the agro climatic conditions of district Bhimber, Azad Kashmir.

II. Materials And Methods

The experiment was laid out in Randomized Complete Block Design (RCBD) with two factor factorial having 15 treatments and each treatment was replicated 3 times. The plot size was kept 1.5 m x 2 m (4.5 m^2). Row to row and plant to plant distance was kept 1.5 m and 60 cm respectively. There were two factors studied in this experiment:

Factor A: Three different bitter gourd cultivars i.e. Faisalabad Long, Jaunpuri and Palee were studied.
Factor B: Various soaking durations i.e. 4, 8, 12 and 16 hours along with control. Data was recorded considering following parameters:

- Germination percentage
- Number of days to emergence
- Number of days to first flowering
- Number of branches $plant^{-1}$
- Fruit $plant^{-1}$

III. Results And Discussion

Germination percentage (%)

Regarding mean values of experimental results, the maximum germination percentage (85.56%) was recorded in cultivar Palee followed by cultivar Faisalabad long (78.89%), whereas the minimum germination percentage (65.57%) was observed in cultivar Jaunpuri. While mean values for soaking duration indicated that the maximum germination percentage (85.18%) was recorded in plants in which seeds were soaked for 12 hours. However, it was at par with the germination percentage (81.48%) of plants, primed for 16 hours. Whereas the minimum germination percentage (70.38%) was observed in plants in which seeds were unprimed. The interaction between soaking duration and cultivars was non significant, however the highest germination percentage (94.44%) was recorded in cultivar Palee in plants in which seeds were soaked for 12 hours and the least germination percentage (61.13%) was recorded in control plot. The possible fact for better percent germination by priming may be that it stimulates series of biochemical change in the seed that are essential to initiate the emergence process like break down dormancy, hydrolysis, metabolism of growth inhibitors, imbibitions, activation of enzymes (Ajouri *et al.,* 2004; Farooq *et al*., 2009; Pukacka and Rajajczak, 2005). Variations among cultivars may be attributed to genetic potential of the cultivar.

Table 1. Germination percentage as affected by seed soaking of bitter gourd cultivars.

Soaking duration (hours)	Cultivars			
	Faisalabad Long	Jaunpuri	Palee	Mean
0	72.24	61.13	77.78	70.38 b
4	72.24	61.13	83.34	72.24 b
8	77.78	61.13	83.34	74.08 b
12	88.88	72.23	94.44	85.18 a
16	83.33	72.24	88.88	81.48 a
Mean	78.89 b	65.57 c	85.56 a	

LSD value at 5% for cultivars = 4.710
LSD value at 5% for soaking durations = 6.080
Means followed by the same letter are not significantly different using LSD test at 5% level of probability

Number of days to emergence

According to mean values the highest numbers of days to emergence (7.45) were recorded in plants having non-soaked seed, however, the less number of days to emergence (6.28) were found in plants, soaked for 16 hours. The bitter gourd cultivars showed a significant variation for number of days to emergence. The mean data indicated that cultivar Jaunpuri took more days to emergence (7.57) than cultivar Palee (6.47) and Faisalabad Long (6.37).

The interaction of bitter gourd cultivars and soaking duration showed the maximum numbers of days to emergence (8.00) were noted in cultivar Jaunpuri in non soaked seeds. However, the minimum number of days to emergence (5.77) were recorded in cultivar Faisalabad Long in which seeds were soaked for 16 hours. Seed soaking significantly minimized the emergence time over non-soaked seeds. Variations among cultivars may be attributed to genetic potential of the cultivar. Soaking stimulates and produces enzymes like amylase and lipase which activate storage materials in seeds. Rehydration causes early emergence due to the fact that all pregerminative processes for germination had already occurred in seed. The similar results were coincide with

the findings of Farooq *et al*., 2009, who evaluated that mobilize antioxidant enzymes which subordinate per oxidation in seeds which retain seed vigor causing earlier emergence.

Table 2. Number of days to emergence as affected by seed soaking of bitter gourd cultivars.

Soaking duration (hours)	Cultivars			
	Faisalabad Long	Jaunpuri	Palee	Mean
0	7.15	8.00	7.20	7.45 a
4	6.92	7.96	7.20	7.36 a
8	6.16	7.50	6.17	6.61 b
12	5.88	7.23	5.90	6.34 bc
16	5.77	7.16	5.90	6.28 b
Mean	6.37 b	7.57 a	6.47 b	

LSD value at 5% for cultivars = 0.2244
LSD value at 5% for soaking durations = 0.2897
LSD value at 5% for interaction = 0.1296
Means followed by the same letter are not significantly different using LSD test at 5% level of probability

Number of days to first flowering

Mean values for soaking duration indicated that more number of days to first flowering (41.05) were recorded in plants of non-soaked seeds. The soaking duration of 0, 4, 8 and 12 hours had non significant variations for number of days to flowering. However, all these treatments had a significant differences with plants in which seeds were soaked for 16 hours, took 39.40 days to first flowering. Means value for cultivars indicated that the maximum days to first flowering (41.14) were taken by cultivar Jaunpuri, whereas less numbers of days to first flowering (39.55) were observed in cultivar Palee. The interaction of bitter gourd cultivars and soaking duration showed that the higher numbers of days to first flowering (42.33) were noted in cultivar Jaunpuri in non-soaked seeds. While least numbers of days to first flowering (38.06) were recorded in cultivar Faisalabad Long, in which seeds were soaked for 16 hours. Generally seed soaking effect the early flowering which ultimately influenced the maturity period. Days to flowering is related with physiological maturity. It is regarded as changing of vegetative stage into the reproductive phase. Seed dormancy breakdown and growth rate boost up than normal growth rate. Murungu *et al*. (2004) reported that seed soaking of tomatoes minimize days to flowering. The present results are also correlated with Harris *et al*. (2000) who reported that rice priming causes earlier flowering in the crops and enhanced the yield. Variations among cultivars might be due to inherit charecteristics of the cultivar.

Table 3. Number of days to first flowering as affected by seed soaking of bitter gourd cultivars.

Soaking duration (hours)	Cultivars			
	Faisalabad Long	Jaunpuri	Palee	Mean
0	40.96	42.33	39.86	41.05 a
4	40.26	41.33	39.33	40.31 a
8	40.96	40.13	39.66	40.25 a
12	39.80	41.33	39.36	40.16 a
16	38.06	40.60	39.53	39.40 b
Mean	40.01 b	41.14 a	39.55 b	

LSD value at 5% for cultivars = 0.476
LSD value at 5% for soaking durations = 0.6145
LSD value at 5% for interaction = 0.2748
Means followed by the same letter are not significantly different using LSD test at 5% level of probability

Number of branches plant^{-1}

Seed soaking significantly influenced the number of branches plant^{-1}. Mean values showed that the highest numbers of branches plant^{-1} (8.64) were obtained when seeds were soaked for 12 hours, while the less numbers of branches plant^{-1} (7.00) were noted in plants of non soaked seed. The mean values for cultivars

indicated that the higher numbers of branches plant^{-1} (8.86) were produced by cultivar Palee, while less numbers of branches plant^{-1} (6.49) were found in cultivar Jaunpuri. The interaction between soaking duration and cultivars was found non significant, however the highest numbers of branches plant^{-1} (9.93) were noted in cultivar Palee when seeds were soaked for 12 hours. While least numbers of branches plant^{-1}(5.83) were recorded in cultivar Jaunpuri of un soaked seed. The increase in numbers of branches plant^{-1} by seed soaking could be due to earlier emergence and better established of crop causes more numbers of branches plant^{-1}.

The variations in numbers of branches plant^{-1} among the cultivars may be attributed to genetic variation as some cultivars having characteristics of more vegetative growth. The above results in line with Ullah *et al*. (2002) who reported that pre sowing treatments of raya seed encourage growth of crop, reduced days to emergence, numbers of branches plant^{-1} and plant yield. Among cultivars variations might be due to their inherit characteristics.

Table 4. Number of branches plant^{-1} as affected by seed soaking of bitter gourd cultivars.

soaking duration (hours)	Cultivars			
	Faisalabad Long	Jaunpuri	Palee	Mean
0	7.10	5.83	8.06	7.00 b
4	7.31	5.96	8.23	7.17 b
8	7.56	6.00	8.36	7.31 b
12	8.50	7.50	9.93	8.64 a
16	8.16	7.16	9.73	8.35 a
Mean	7.73 b	6.49 c	8.86 a	

LSD value at 5% for cultivars = 0.5923
LSD value at 5% for soaking durations = 0.7646
Means followed by the same letter are not significantly different using LSD test at 5% level of probability

Numbers of fruits plant^{-1}

Soaking durations showed a significant difference for the numbers of fruits plant^{-1}. Mean values for soaking duration indicated that the highest numbers of fruits plant^{-1} (20.70) were produced, when seeds were soaked for 12 hours, while the less numbers of fruit plant^{-1} (16.68) were recorded in plants of non soaked seed. Among cultivars, Palee produced higher number of fruits plant^{-1} (21.09), while cultivar Jaunpuri produced less number of fruit plant^{-1} (14.52). The interaction of bitter gourd cultivars and soaking duration revealed that the more numbers of fruits plant^{-1} (23.0) were observed in cultivar Palee in which seeds were soaked for12 hours. While less numbers of fruits plant^{-1} (12.10) were produced by cultivar Jaunpuri of unprimed seeds. The possible reason for more numbers of fruits plant^{-1} might be due to earlier emergence and better established of seedlings which causes more number of fruits^{-1}. Same kind of findings observed by Harris *et al*. (2000) who reported that earlier emergence and better established of seedlings increased the number fruits plant^{-1} in rice. Variations among cultivars in numbers of fruits plant^{-1} may be attributed to inherit characteristics of the cultivar.

Table 5. Number of fruits plant^{-1} as affected by seed soaking of bitter gourd cultivars.

Soaking duration (hours)	Cultivars			
	Faisalabad Long	Jaunpuri	Palee	Mean
0	17.36	12.10	20.60	16.68 c
4	18.96	13.20	19.40	17.18 c
8	20.33	14.73	20.13	18.40 b
12	21.46	17.63	23.00	20.70 a
16	19.63	14.96	22.33	18.97 b
Mean	19.53 b	14.52 c	21.09 a	

LSD value at 5% for cultivars = 0.8018
LSD value at 5% for soaking durations = 1.035
LSD value at 5% for interaction = 0.4629
Means followed by the same letter are not significantly different using LSD test at 5% level of probability

IV. Conclusion And Recommendations

In conclusion, soaking duration of tomato seeds has the potential to enhance germination and seedling growth. . Water soaking for 12 hours effectively enhanced emergence, seedling vigor, crop establishment of the bitter gourd cultivar. . Similarly, cultivar Palee proved best in terms of getting maximum germination and

increased growth under the agro-climatic conditions of district Bhimber, Azad Kashmir. This soaking procedure though simple and almost at no cost, is capable of improving crop yield and boasting farmers income and is hereby recommended for adoption by farmers.

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