

Effects of Stages of Harvest and Drying Methods on Seed Quality in Bitter Gourd

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ABSTRACT Fruits harvested at orange red stage recorded the highest dry weight of 100-seed (26.38 g), germination (88.81%), shoot length (13.93 cm), seedling dry weight (136.18 mg) and vigour index (2665) compared to fruits harvested at early or late stage of maturity. Drying methods showed significant influence on seed quality parameters. Among the different methods of drying, seeds dried in hot air oven at 35°C recorded maximum germination (84.68%), root length (17.88 cm), seedling dry weight (135.60 mg) and vigour index (2710), which was on par with shade drying.

Key words: *Momordica charantia*, stages of harvest, drying methods, germination, vigour index

Bitter gourd (*Momordica charantia* L.) is an important cucurbitaceous vegetable crop grown for its fleshy fruits in tropical and subtropical regions. The seed quality largely depends on the stages of maturity. Harvesting either at early or late stage results in lower seed yield with poor quality seeds. Very little work has been done on stages of harvest of fruits and drying of seeds by different methods in bitter gourd. Therefore, it was considered worthwhile to standardise stages of harvest and drying methods on seed quality in bitter gourd.

MATERIALS AND METHODS

The seed material used for this experiment was obtained from the crop raised for the purpose at Olericulture Research Unit, Kittur Rani Channamma College of Horticulture, Arabhavi. The varieties used was Coimbatore long (green). The crop was sown during the second fortnight of November 2002-03. The land was well prepared, ridges and furrows were opened at a distance of 120 cm apart. The recommended dose of fertilizers (NPK 62.5:50:0 kg/ha) were incorporated into soil along with 25 tonnes of FYM per hectare. Two to three seeds per hill were dibbled at a spacing of 90 cm within the row.

The plants were thinned leaving only one seedling per hill for seed purpose. Later the vines were trailed on wires tied to wooden poles. The plant protection measures were adopted as and when required. The fruits were harvested in three different stages from second fortnight of February to second fortnight of April, viz., colour break, orange red and cracking, stages. The fruits harvested from each stage were used for recording fresh weight of fruit and fresh weight of 100-seeds. The seeds were extracted from each stage. The fresh seed lots from each stages were divided into sub-lots. Each sub-lot from each stage was subjected to sun drying for a period of 17 h, shade drying for a period of 172 h and oven drying at 35°C or 11 h simultaneously. The mean maximum and minimum temperature prevalent during drying period was 36.02°C and 26.86°C, respectively. After drying, dry weight of 100-seed, germination, root length, shoot length, seedling dry weight and vigour index were recorded. The laboratory germination test was conducted as per ISTA procedure [1] by adopting rolled towel method. The 50 seeds in each batch were kept for germination with eight replications.

For seedling dry weight, 10 randomly selected normal seedlings were taken during standard

germination test and were dried in butter paper packets in hot air oven at 75°C for 24 h [2]. Thereafter, the seedling were removed and cooled in desiccators for 30 minutes. The weight of the dried seedling was recorded and the dry weight per seedling was calculated. The vigour index of seedlings was calculated by adopting the method suggested by Abdul-Baki and Anderson [3].

$$\text{Vigour index} = \frac{\text{Germination (\%)} \times \text{Total seedling length (cm)}}{\text{Total seedling length (cm)}}$$

RESULTS AND DISCUSSION

In the present study, stages of fruit harvesting significantly influenced by fresh weight of fruit or seed quality (Table 1). Harvesting of fruits at colour break stage recorded the highest fruit weight (200.90 g) and fresh weight of 100-seed (41.41 g) as compared to orange red stage (183.70 and 37.70 g, respectively) and cracking stage (168.70 and 36.27 g, respectively). The higher fruit weight and fresh weight of 100-seeds obtained in colour break stage might be due to higher moisture content in fruit as well as in seed.

Table 1. Effects of stages of harvest on fresh weight of fruit (g) and 100-seed (g) in bitter gourd

Stages of harvest (H)	Fresh weight of fruit (g)	Fresh weight of 100-seed (g)
H ₁ - Colour break	200.90	41.41
H ₂ - Orange red	183.70	37.70
H ₃ - Cracking	168.70	36.27
Mean	184.47	38.50
S.Em.±	1.74	0.55
C.D. at 5%	5.12	1.61

Stages of harvest showed significant influence on dry weight of 100-seed and other seed quality parameters (Tables 2&3). Fruits harvested at orange red stage recorded the highest dry weight of 100-seed (26.38 g), germination (83.81%), shoot length (13.93 cm), seedling dry weight (136.18 mg) and vigour index (2665) compared to fruits harvested at early or late stage of maturity. Higher values of all these seed/seedling quality parameters in orange red stage indicated

physiological maturity of fruit. Physiologically matured seeds are completely developed with maximum accumulation of food reserves from source to sink with completion of biochemical processes. The seeds obtained from colour break stage were poor, immature, which is evident for lower seed quality. The results are in accordance with the findings of Jayabharathi et al. [4] in brinjal, Chaudhari et al. [5] in tomato, Nandeesh et al. [6] in cucumber and Naik et al. [7] in capsicum.

Different seed drying methods showed non-significant influence on dry weight of 100-seeds (Table 2). Drying methods showed significant influence on other seed quality parameters (Tables 2&3). Among the different methods of drying, drying the seeds in hot air oven at 35°C recorded higher germination (84.68%), root length (17.88 cm), seedling dry weight (134.20 mg) and vigour index (2710), which was on par with shade drying. The higher seed quality in oven drying and shade drying could be attributed to constant temperature maintained in oven and in shade led to higher seed quality. The poor seed quality in sun dried seeds could be due to direct exposure of seeds to ultra-violet radiation associated with faster rate of desiccation and inturn seed deterioration. These results are in conformity with the findings of Nerson [8], Nascimento et al. [9], Suryawanshi et al. [10] and Ravikumar [11] in cucumber, Javaregowda et al. [12] in brinjal, Mini et al. [13] in ash gourd. Harrington [14] reported that direct sunlight is harmful to seed viability due to ultra-violet radiation. He concluded that sun drying is replaced with shade drying or artificial drying. Interactive effects of stages of harvest and drying methods on fruit and seed quality were non-significant.

From the results of the present study, it is concluded that bitter gourd fruits should be harvested at orange red stage and seeds either dried under hot air oven at 35°C or shade for getting higher seed quality.

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Table 2. Effects of stages of harvest and drying methods on dry weight of 100-seeds, germination and root length in bitter gourd

Stages of harvest (H)	Dry weight of 100-seeds (g)				Germination (%)				Root length (cm)			
	D ₁	D ₂	D ₃	Mean	D ₁	D ₂	D ₃	Mean	D ₁	D ₂	D ₃	Mean
H ₁ -Colour break	24.48	24.90	24.35	24.58	78.80 (62.63)*	81.20 (64.32)	82.80 (65.54)	80.93 (64.16)	15.70	16.00	17.60	16.43
H ₂ -Orange red	26.38	26.58	26.18	26.38	81.50 (64.54)	84.30 (66.68)	85.63 (67.80)	83.81 (66.34)	17.60	18.00	18.34	17.97
H ₃ -Cracking	26.08	26.20	26.19	26.16	80.30 (63.56)	83.90 (65.99)	85.60 (67.72)	83.27 (63.78)	17.50	17.30	17.73	17.51
Mean	25.65	28.89	25.57	25.70	80.20 (63.58)	83.13 (65.67)	84.68 (67.02)	82.67 (65.42)	16.93	17.10	17.88	17.30
For comparing the means of	S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%	
H	0.38	1.11		0.71	2.09		0.21	0.62		0.21	0.62	
D	0.38	NS		0.71	2.09		0.21	0.62		0.21	0.62	
HxD	0.65	NS		1.23	NS		0.36	NS		0.36	NS	

Drying method (D): D₁ - Sun drying; D₂ - Shade drying; D₃ - Oven drying at 35°C; NS - Non-significant; *Figures in the parenthesis indicate angular transformed values

Table 3. Effects of stages of harvest and drying methods on shoot length, seedling dry weight and vigour index in bitter gourd

Stages of harvest (H)	Shoot length (cm)				Seedling dry weight (mg)				Vigour index			
	D ₁	D ₂	D ₃	Mean	D ₁	D ₂	D ₃	Mean	D ₁	D ₂	D ₃	Mean
H ₁ -Colour break	13.10	13.20	13.20	13.17	129.4	131.2	131.6	130.7	2269	2362	2550	2394
H ₂ -Orange red	13.40	14.10	14.30	13.93	134.8	135.6	138.1	136.2	2518	2647	2831	2665
H ₃ -Cracking	13.00	13.20	13.80	13.33	134.2	135.4	137.2	135.6	2473	6818	2748	2613
Mean	13.17	13.50	13.77	13.48	132.8	134.1	135.6	134.2	2420	2542	2710	2557
For comparing the means of	S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%		S.E.m.±	C.D. at 5%	
H	0.19	0.56		1.18	3.47		49	143		49	143	
D	0.19	NS		1.18	NS		49	143		49	143	
HxD	0.33	NS		4.19	NS		84	NS		84	NS	

Drying method (D): D₁ - Sun drying; D₂ - Shade drying; D₃ - Oven drying at 35°C; NS - Non-significant

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