Effect of different pre-treatment to break seed dormancy of stored bitter gourd seeds in refrigerated condition

H.M.P.S. Kumari, P.U. Nisansala, E.P. Wijewardhane and D.P. Sumanasinghe

Horticultural Crops Research and Development Institute, Gannoruwa, Sri Lanka

Introduction

Bitter gourd is one of the most important vegetables grown in Sri Lanka and many countries as an edible fruit and for medicinal benefits. Bittergourd fruits are a good source of carbohydrates, proteins, vitamins, and minerals and have the highest nutritive value among cucurbits (Miniraj *et al*., 1993; Desai and Musmade, 1998). Bitter gourd extracts possess antioxidant, antimicrobial, antiviral, antihepatotoxic and antiulcerogenic properties while also having the ability to lower blood sugar (Welthinda *et al*., 1986; Raman and Lan, 1996). Seeds are used as planting material for bitter gourd. Though bitter gourd seeds considered as orthodox seeds, rapid germination losses observed with storage with seed deterioration and hard seed coat (Delouche, 1974). Seed deterioration occurs due to lipid peroxidation with lowering germination, delayed emergence and death of the seeds (McDonald, 1999). Hard cutinized testa of some bitter gourd seeds completely prevent imbibition of water and exchange of gases resulting in decrease germination and germination of bitter gourd seed is adversely affect at low temperatures (Fonseka *et al*., 2011). There is a positive association between lowering germination rate of the seeds with increased biochemical products (Malondialdehyde) and seed dormancy switched on and off at different temperatures (Wang *et al.*, 2003). To overcome this problem seed pretreatment can be practiced and seed priming as hydro-priming with water and osmo-priming solution like KNO_3 allows imbibe water and proceed to the first stage of germination (Fonseka *et al*., 2011). Hydro-priming is a simple technique which can help to increase effectiveness of farm priming. This method has been adopted by many farmers in many countries. Seed priming is also a solution to overcome mechanical restriction on embryo growth by thick seed coat and to overcome bio-chemical restrictions by increasing soluble fatty acids (Mcdonald, 1999). Seed pre- treatment resulted in higher germination, earlier seedling emergence, strong growth, lower seed rate requirement and dead seeds and low vigor seeds can be discarded before sowing (Wang *et al*., 2003). Thinneweli white and Matale green are recommended open pollinated bitter gourd varieties in Sri Lanka. The present study

***** Short Communication***

was conducted to understand the effect of seed pre-treatments on germination, breaking dormancy and recovery of stored bitter gourd seed samples from Thinnaweli white and Matale green varieties in refrigerated condition.

Materials and methods

The study was conducted at the Horticultural Crops Research and Development Institute, Gannoruwa. Two kilos of seeds from each variety produced at HORDI and seeds properly prepared and different seed lots were with above 85% germination and 9% moisture at start to maintain standard storing condition. Seeds stored in refrigerated conditions for six months, one, two and three years were used for this research. Four hundred seeds included in each replicate with Complete Randomized Design (CRD) and they were replicated three times with four seed treatments for germination test. Seed treatments included 24 hour soak in water as a control because that is the normal practice method done by farmers and researchers. Other selected treatments included as hot water treatment at 40 ^{0}C for 4 hrs and put in germinating trays, soaking seeds for two hours in vinegar, washed thoroughly and put in germinating trays and two hours in 0.2% KNO_3 washed thoroughly and put in germinating trays. Seed germination observed up to three weeks in laboratory condition at room temperature (25-28 ^{0}C) according to ISTA (1996) standards and germinated plants established in field to observe growth vigor. Data were analyzed using SAS statistical software version 9.1.

Results and discussion

Both tested varieties showed lowering germination percentage with longer the time of conservation. Though seed germination depends on many different seed physiological factors, results reveal significantly lower percentage of germination or breaking dormancy with time of conservation compared to 85% initial germination with all the treatments. Tested treatments used for the purpose of soften the hard seed coat of bitter gourd and prevent growth inhibition to facilitate the germination. Hot water treatment and 0.2% KNO_3 showed higher percentage of germination with both tested varieties for all four seed lots than other treatments.

Table 1. Mean seed germination percentage of bitter gourd with different priming treatments

Seed treatment	Seed germination %							
	6 months old		I year old		2 years old		3 years old	
	TW	MG	TW	MG	TW	MG	TW	MG
Hot water 40 ^{0}C for 4 hrs	80^a	90^a	80^a	90^a	60^{bc}	75^a	30^{cd}	60^a
Vinegar 1% (2 hrs)	70^b	80^b	50^{bc}	80^b	30^e	60^c	10^d	55^b
KNO_3 0.2% (2 hrs)	80^a	85^{ab}	80^a	80^b	60^{bc}	70^b	30^{cd}	55^b
Control (24 hr soak in water)	70^b	75^c	50^c	60^c	30^{cd}	60^c	10^d	30^c
CV %	5.9	9.1	2.62	6.17	3.13	9.48	4.51	11.0

Mean in each column followed by the same letters are not significantly different(p=0.05)

TW =Thinnaweli White, MG= Matale Green

Results observed with control samples indicated rapid decrease in seed germination with the increase of storage time and that results revealed normal conventional seed soak treatment was not sufficient to break dormancy in some viable seeds. This observation can be explained with bio-chemical reactions of bitter gourd seeds which may affect direct germination with development of secondary dormancy with time of storage according to Wang *et al*. (2003). The amount of effective chemicals in imbibed primed and hot water soaked seeds may be reduced peroxide scavenging enzymes to help germination of seeds with appropriate temperature at 40 ^{0}C.

Both percentage and speed of emergence were observed in higher with hot water treated seeds than control (Table 1). Gradually decreased recovery was observed with both of the tested varieties (Figure 1). Lowering recovery of seeds from their developed seed dormancy may be related with seed deterioration with time of storage (Delouche, 1974).

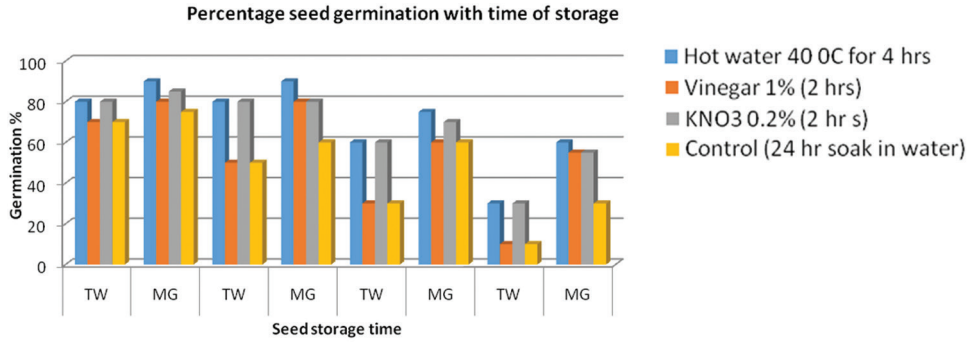

Figure 1. Seed germination and recovery percentage of TW and MG with time of conservation and pre-treatment

TW =Thinnaweli White, MG= Matale Green

Rapid germination losses observed with bitter gourd variety Thinnaweli white than Matale green and there may be varietal interaction with related morphological characters. Variety Thinnaweli white showed low recovery percentage and germination losses from 85% to 10% during 3 years (Figure 1). Hot water treatment showed the highest seed germination percentage with both of the tested varieties and that could be the most acceptable method for farmers and researchers. Refrigerated condition may not be applicable for long term conservation of bitter gourd seeds and it is better to go for other optimized conditioned for long term storage. Hot water treatment is the most practical method because it is a low cost method and easy to apply even at farmer level.

Conclusion

Hot water treatment at 40 ^{0}C for 4 hours, and two hours in 0.2% KNO_3 treatment could be considered as better treatment to increase seed germination and seed dormancy of selected varieties (Thinnaweli white and Matale green) can be broken by these two pretreatments to achieve more than 50% recovery. Germination percentages were remarkably decreased with increase in storage time in refrigerated condition for both varieties. Hot water treatment at 40 ^{0}C for 4 hours could be considered as a convenient method to apply in research and farmer level with bitter gourd variety Thinnaweli white and Matale Green to overcome low seed germination problem related with seed dormancy.

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