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INFLUENCE OF BIJAMRITA AS PRIMING MEDIA TO ENHANCE SEED GERMINATION AND SEEDLING GROWTH OF SELECTED LEAFY VEGETABLES

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ABSTRACT

Pot experiment was carried out during the year 2020-2021 at Green house of Sri Parasakthi college for Women in Courtallam, Tamil Nadau, to study the influence of Bijamrita as priming media on germination and seedling growth of selected leafy vegetables. For the experiments seeds of four leaf vegetables such as *Amaranthus cruentus* (L.), *Amaranthus polygonoides* (L.), *Brassica nigra* (L.), *Cardiospermum helicacabam* (L.) were selected and primed with different concentrations (1%, 2%, 3% 4% and 5%) of Bijamrita for 12 hours. Among the different concentrations, priming with Bijamrita at 4% was found to be significant in promoting seed germination (83%-98%) shoot length (3.15 cm- 5.03 cm), root length (1.91cm-2.76 cm) fresh weight (1.258 g-1.95 g), dry weight (0.045 g-0.751g) and seed vigour (419.98-677.73) of all the selected four leafy vegetables compared to control. From the above experiment, it could be inferred that bijamrita is an effective organic formulation for sustainable crop production.

(Key words: Leafy vegetables, Bijamrita, germination, priming, seed vigour)

INTRODUCTION

Organic farming has emerged as one of the better options to address the sustainability of agriculture and effective utilization of natural resources. There is great deal of interest in organic farming around the world and India. Organic producers use naturally available materials and processes when developing farming systems. The main purpose of practicing organic farming is to develop sustainable and eco-friendly enterprises at the same time.With due climate change, the existence of unpredictable rainfall, most of the times farm saved grains are used as seeds, while the changing environment conditions also affect the crop establishment and leading to crop failure.

Seed priming is one of the key solution to overcome these problems and is very simple to adopt and being a low cost technology too, especially for dry land farmers.

In the era of synthetic world the usage of chemicals as seed priming media is affecting the seed and soil ecosystem. Hence, the safe and practical approach is the priming of seeds with organics which is eco-friendly, economical, easily available and can be done on-farm. Organic seed priming provides resistant to high temperature and low moisture especially in semiarid tropics. It encourages quicker germination, greater seedling vigour resulting in increased crop productivity especially in advanced countries it integrates the biological and physiological aspects of enhancing growth, disease control and increase in yield (Iswariya *et al.,* 2019).

Liquid formulations that are used in organic agriculture like panchagvya, beejamrutha and jeevamrutha are the fermented products which are used as plant growth enhancing substances prepared with material available with farmers. They are the rich sources of beneficial micro flora which support, stimulate the plant growth and help in getting better vegetative growth and also good quality yield (Devakumar *et al.*, 2014).

Beejamrita is organic liquid manure which is used for seed treatment for different crops. It is an effective organic preparation which protects the seed from various fungal and bacterial diseases (Shyamsunder and Sandeep Menon, 2021).

Leafy vegetables are source of carbohydrates, also typically contains less fat and calories. These are known to contain bioactive compounds such as niacin, omega-3-fatty acid, flavonoids, carotenoids and essential nutrients. These compounds can provide anti-oxidant and anti-inflammatory properties.Many technologies were adopted to increase the yield and quality of amaranthus till now but production of pesticide free produces are difficult to farmers (Kanthasamy and Manikandan, 2020).

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Study plants

***Amaranthu scruentus* (L.)**

It is an annual herbaceous plant which reproduces only by seeds and has a short growing period: of 4–6 weeks, belongs to the family Amaranthaceae. It produces one dominant, large, central root (tap root). Thick stems are often straight and branched, 0.1 to 2.0 m in height, ribbed, and red dyed. Leaves are arranged spirally, simple, without stipules, and their shape varies from ovate to rhombic-ovate. Small fine hairs cover leaf and stem surfaces. Numerous unisexual flowers are green and form finger-like spikes with long and dense terminal panicle and axillary spikes below. The terminal spike is often lax. There are 5 tepal segments, which are lanceolate, acute, 2-3 mm long, with a sharp and long tip, causing the inflorescence to feel distinctly prickly. Five, 1 mm long stamens form a male flower, while the female flower is a 1-celled ovary crowned by 3 stigmas. At maturity, the whole plant may be reddish.

***Amaranthus polygonoides* (L.)**

A terrestrial prostrate herb with soft spikes on young shoots. Leaves ovate, long petioled, apex deeply notched. Flowers simple in axillary spikes. Inflorescences axillary, congested clusters. Bracts of pistillate flowers lanceolate or linear, 1-1.5 mm, 1/2 as long as tepals. Seeds are dark reddish brown to black, lenticular, 0.8-1 mm diam., shiny. It belongs to family Amaranthaceae.

***Brassica nigra* (L.)**

Annual, rigid, erect herb of Brassicaceae, 40-90 (-120) cm high, branched, more or less hispid. Lower leaves lyrate, deeply pinnatifid or-sect, 6-20 x 4-12 cm; the upper smaller, sessile or short stalked, narrowly elliptic or lanceolate, entire.

Inflorescence a branched raceme, densely 40-50 flowered. Flowers 1.2 cm across; pedicels 3-5 mm long, ebracteate.Sepals erect-spreading, oblong, obtuse, 4-5 mm long, glabrous. Petals obovate, long-clawed, 8-10 mm long, bright yellow. Stamens are 4 mm long. Fruits oblong, 1-2 cm x 1-2.5 mm; beak 2-3 mm long, seedless; valves keeled, torulose, 3-5 seeded in each locule; seeds ca 1 mm across, glabrous, dark brown.

***Cardiospermum helicacabam* (L.)**

Climbing or trailing herbs of Sapindaceae family. Leaves alternate, bi-ternate; leaflets 2-4 x 1-2.5 cm, ovate-lanceolate, deeply dentate or lobed, apex acute to acuminate, membranous; petiole up to 3 cm long. Flowers white, polygamous in 3-7-flowered axillary tendril-bearing peduncles; peduncle up to 5 cm long. Sepals 4, in 2-pairs, outer pair smaller. Petals 4, white, unequal, with basal scales.Stamens 8; filaments unequal, pilose.Ovary 3-locular; ovule 1-per locule; stigma 3-fid.Capsule papery, inflated, 3-lobed, winged.Seeds one in each chamber, black with a white eye.

Keeping in view of the above facts, the present investigation was carried out to study the effect of Bijamrita on the seeds of leafy vegetables.

MATERIALS AND METHODS

Preparation of Bijamrita

Bijamrita was prepared from 20 litres water, 5 kg local cow dung, 5 litres local cow urine, 50 g lime and handful of soil from the bund of the farm. 5 kg of local dung was taken in a cloth and bound it by tape. Hanged this is in the 20 litre water up to 12 hours. One litre of water was taken and 50 g lime was added and kept it for a night. Then next morning, this bundle of the cowdung was squeezed in that water thrice continuously, so that all essence of cowdung would accumulate in that water. Then added a handful of soil in that water solution and stir it well. Then, added 5 litre deshi cow urine in that solution and lime water was also added and stirred well (Palekar, 2006).

Pot experiment was conducted by using leafy vegetables. Seeds of the above said leafy vegetables procured from local nursery at Tenkasi, Tamilnadu, India. Fifty seeds of each plant sample were soaked in 1%, 2%, 3% 4% and 5% solution of Bijamrita for 12 hours and allowed it to dry before sowing them in the pot. Seeds directly sown in soil without treatment were used as control. The priming media was sprayed at regular intervals.Plants were allowed to grow in the greenhouse. Seedlings were harvested after 25 days of planting. Ten seedlings of different leafy vegetables in each treatment were randomly selected for the measurement of root and shoot length, fresh and dry weight. Germination percentage and seedling growth recorded up to 25 days.

Germination percentage was calculated by

Percentage of Germination = No. of seeds germinated/No. of seeds sown x100

Growth parameters

The various growth parameters were measured on 25 days after seeding.

Root and shoot length

Root and shoot length were recorded from randomly selected ten plants in each treated pot.

Vigour Index (VI) was calculated according to the method suggested by Abdul-Baki and Anderson (1973).

Vigour Index = (Root length + shoot length) x Germination percentage

Fresh weight and dry weight plant^{-1}

For this purpose, ten plants from each treatment were uprooted, cleaned and fresh weight was taken. The respective plants were kept in oven separately at 80^{o}C for 72 hours and then dry weights were recorded.

RESULTS AND DISCUSSION

The results shows that seed priming with Bijamrita had a significant effect on seed germination, seedling growth of all the four selected leafy vegetables.

Table1 shows the effect of Bijamrita on seed germination. Soaking of seeds in Bijamrita significantly increased the germination percentage of all the four plant samples. Highest (98%) percentage of seed germination was recorded for the seeds of *Amaranthus cruentus* followed by *Brassica nigra* showed 93% of seed germination. For the all the four selected leafy vegetables, percentage of seed germination was more in the concentration of 4% bijamrutha. Vyankatrao (2019) showed that the seed germination of legume crops i.e. *Arachis hypogaea* (L.) (100%), *Glycine max* (L.) Merr (83-96%).*Vigna acontifolia* (Jacq.) Marechal (100%) and *Vigna radiata* (L.) R. Wilczek (85-97%) was increased by using 100 % of Bijamrut.

Sornalatha *et al*. (2018) in ridge gourd concluded that seed treatment with combination of Bijamrutha and Jeevamrutha has better germination percentage (95%) when compared to control (82.5%), this might be due to the presence of useful bacteria in Bijamrut produces IAA (Indole acetic acid) and GA (Gibberellic acid). Shakuntala *et al*. (2012) also observed that paddy seeds treated with beejamruth 50% recorded higher germination percentage (85.37%), seedling vigour index (2805) as compared to control.

The height (shoots and root length) of the all the plant samples were significantly higher when compared to control. Highest shoot and root length was also recorded for all the seeds soaked at the concentration of 4% (Table 2). Beejamruth treated finger millet seeds showed significantly highest shoot (9.35 cm) and root length (7.2 cm) (Jha *et al*., 2020). The higher root and shoot lengthmight be due to the presence of organic C, N, P, K which were made available by beneficial micro flora present in the beeja mrutha. This availability is very much required for plant nutrition. Bijamrutha contains not only general microflora, but also certain beneficial biochemical groups such as free living N_2-fixers, P- solubilizers and bacteria producing plant growth promoting substances as well as bacteria having biological deterrent activities.Presence of such beneficial microbial biomass and nutrient status might have resulted in improved seed germination, seedling length and seed vigour in soybean indicating bijamrutha as an efficient plant growth stimulant (Sreenivasa *et al*., 2009).

Seed priming with organic liquids increase the free radical scavenging enzymes to improve seed viability and strength. Vishwanath *et al.* (2015) suggested that seed priming decreased the resistance of the endosperm envelope to expansive growth allowing the turgor threshold for germination to be reached faster than in non-primed seeds thereby greater root and shoot length. Similarly Ambika *et al*.(2014) studied the effect of pre sowing seed treatments of coarse cereals with bovine urines and reported that cow urine at 5 per cent recorded significantly higher seed germination (94%), as compared to other treatments and control (82%).

Priming with Bijamrita also increased the seed vigour index (Table 3) of all studied leafy vegetables compared to control. Koulag (2018) reported that paddy seeds primed with beejamrutha increased germination percentage (98%), vigour index I (1264.20) as compared to control.

Similarly, soaking of seeds in Bijamrita increased fresh and dry weights (Table 4) of all the four seedlings. Increase in the fresh and dry weight of different plant parts might be due to the effect of cow urine as it contains N, P, K, urea, salts, minerals, hormones, enzymes and other growth promoting substances. Korade *et al*. (2019) reported two foliar sprays of 6% cow urine significantly increased the dry matter production of wheat over control.

Seed quality of leafy vegetables was significantly influenced by organic seed priming treatments. Seed priming with Bijamrita at 4% was found to be significant in promoting seed germination and seedling growth of all the selected four leafy vegetables compared to control. Liquid formulations that are used in organic agriculture like Bijamrita is the fermented products which are used as plant growth enhancing substances prepared with material available naturally. They are the rich sources of beneficial micro flora which support, stimulate the plant growth and help in getting better vegetative growth and also good quality yield.

Table 1. Effect of Bijamrita on seed germination of some selected leafy vegetables

S.No.	Plant Samples	% of seed germination treated					
		Control	1%	2%	3%	4%	5%
1.	*Amaranthus cruentus* (L.)	61%	70%	76%	80%	98%	84%
2.	*Amaranthus polygonoides* (L.)	71%	73%	76%	82%	87%	81%
3.	*Brassica nigra* (L.)	77%	83%	85%	85%	93%	90%
4.	*Cardiospermum helicacabam* (L.)	58%	63%	69%	74%	83%	80%

Table2. Effect of Bijamrita on shoot and root length of some selected leafy vegetables

S.No.	Plant samples	Shoot length (cm)						Root length (cm)					
		Control	Treated					Control	Treated				
			1%	2%	3%	4%	5%		1%	2%	3%	4%	5%
1.	*Amaranthus cruentus* (L.)	2.15	2.92	3.21	3.44	4.52	3. 63	1.31	1.39	1.51	1.80	2.01	1.62
2.	*Amaranthus polygonoides* (L.)	1.57	2.27	2.85	3.89	5.03	4.04	1.07	1.55	1.69	1.87	2.76	2.01
3.	*Brassica nigra* (L.)	2.50	2.71	3.01	3.49	4.78	3.51	1.23	1.31	1.47	1.65	2.11	1.81
4.	*Cardiospermum helicacabam* (L.)	2.23	2.27	2.35	2.42	3.15	2.48	1.01	1.18	1.45	1.72	1.91	1.75

Table 3. Effect of Bijamrita on seed vigour of some selected leafy vegetables

S.No.	Plant samples	Fresh weight (g)						Dry weight (g)					
		Control	Treated					Control	Treated				
			1%	2%	3%	4%	5%		1%	2%	3%	4%	5%
1.	*Amaranthus cruentus* (L.)	**0.37**	**0.73**	**0.92**	**1.41**	**1.95**	**0.62**	**0.049**	**0.056**	**0.079**	**0.091**	**0.099**	**0.083**
2.	*Amaranthus polygonoides* (L.)	**0.045**	**0.097**	**0.275**	**0.419**	**1.7**	**1.1**	**0.003**	**0.014**	**0.018**	**0.027**	**0.051**	**0.033**
3.	*Brassica nigra* (L.)	**0.042**	**0.37**	**0.79**	**0.97**	**1.70**	**1.21**	**0.021**	**0.029**	**0.046**	**0.059**	**0.751**	**0.049**
4.	*Cardiospermum helicacabam* (L.)	**0.049**	**0.079**	**0.36**	**0.69**	**1.258**	**0.71**	**0.021**	**0.029**	**0.031**	**0.037**	**0.045**	**0.044**

Table 4. Effect of Bijamrita on fresh and dry weight of seedlings of some selected leafy vegetables

S.No.	Plant Samples	Seed vigour					
		Control	1%	2%	3%	4%	5%
1.	*Amaranthu scruentus* (L.)	211.06	301.70	358.72	396.00	639.94	441.00
2.	*Amaranthus polygonoides* (L.)	187.44	278.86	345.04	472.32	677.73	490.05
3.	*Brassica nigra* (L.)	272.29	333.66	380.80	436.90	640.77	477.90
4.	*Cardiospermum helicacabam* (L.)	187.92	217.35	262.2	293.94	419.98	338.40

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