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Combined Effect of seed fortification and foliar spray with sprouted pulses extract on rice

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ABSTRACT

Experiments were conducted to study the effect of seed and crop fortification with sprouted pulses extracts on seed productivity of rice cv. ADT 43. Seeds fortified with 1, 2, 3, 4 and 5 per cent concentrations of horsegram and cowpea extracts, for 8h and shade dried then subjected to seed germination test to adjudge the optimum treatment. The studies revealed that among all the combinations, seeds fortified with 3 % cowpea extract showed 88 %, 9.65 cm, 19.99 cm, 0.130 g for germination, shoot length, root length and dry matter production, respectively. Control recorded the lowest values (74%, 8.67cm, 15.69cm, 0.120g, respectively). The best treatments were tested in the field along with foliar spray with sprouted pulses extracts @ 1, 2, 3 and 4 per cent levels at two stages viz., active tillering and seed filling stages. Results indicated that seed fortification with 3 % sprouted cowpea extract followed by foliar spray with 2 % cowpea extract showed earliness in tillering and flowering and increase in seed yield attributing factors, and seed yield.

Key words: *effect, sprouted pulse extract, rice, seed quality and yield attributes*

Organic seed is a crucial link in the chain of organic farming encompassing research, breeding, seed production and commercial organic production. Without organic seed the grower of organic seed cannot complete the chain of organic seed production. Furthermore, in many developing countries, agriculture is still largely based on low cost inputs, as the farmers cannot afford the high costs of chemical fertilizers and pesticides. Such farmers require novel low-cost crop management approaches to sustain the crop production. Under such circumstances, development of new organic foliar spray techniques with readily available natural ingredients will help the poor farmers as well as organic farmers to achieve higher yield, with low input cost.

Sprouting is the practice of soaking, draining and incubating the seeds until they germinate. Subsequent to imbibiton of water, sprouting triggers the enzyme activities in seeds which leads elaborate biochemical changes. Besides, water-soluble vitamins such as B complex and vitamin C are created. (Vidal-Valverde *et al*., 2002). Sprouted seeds are rich source of enzymes *viz.,* á-amylase (Mario, 2000), phytase (Eskin and Wiebe, 1983) other digestive enzymes (King and Puwastien, 1987) water soluble vitamins such as Thiamin, Niacin, Vitamin A, B complex, vitamin C (Vidal-Valverde *et al*., 2002) minerals (Oloyo 2003) and soluble sugars (Dey,1990). Because of the favourable accumulation of such bioactive substances, seed sprouting has been identified as an inexpensive and effective technology for improving the nutritional potential of cereals and grain legumes. Horse gram and cowpea are two unexploited legumes are rich in protein and comparatively lower in cost. Therefore, an investigation program was initiated to develop a technology to extract the bioactive substances of horse gram and cowpea sprouts and standardize the optimum concentration of sprouted pulses extract for seed fortification and foliar spray so as to achieve higher seed production in rice.

MATERIALS AND METHODS

Horse gram and cowpea seeds were separately soaked overnight and wrapped in a wet cloth for 12 h to enable

sprouting. Sprouted seeds of horse gram and cowpea weighing 100g each were grounded separately in a mixer-grinder by using 100 ml water ice cold water. The ground paste was squeezed through cloth bag to obtain the extract with 100 per cent concentration. Concentrated extract was diluted with distilled water to five different concentrations *viz.,* 1, 2, 3, 4 and 5% and used for seed fortification and foliar spray.

Rice cv. ADT 43 seeds were fortified with 1, 2, 3, 4 and 5 % of sprouted horse gram and cowpea extract for 8h and dried back to the original moisture content under shade and subjected to germination test as outlined by International Seed Testing Association (1999) and evaluated for germination, shoot length, root length and dry matter production. Experiments were conducted at Tamil Nadu Agricultural University, Coimbatore during 2008 - 2009.

The experiments were conducted at Wet lands of Tamil Nadu Agricultural University, Coimbatore during dry season 2008-2009 in randomized block design with three replicates. All the cultural practices were carried out as recommended for rice seed production. Foliar spray with horse gram and cowpea sprout extracts were taken up at four concentration *viz.,* 1, 2, 3, and 4 % under two growth stages of the crop i.e., 30 days after transplanting (active tillering stage) and 60 days after transplanting (seed filling stage). Unsprayed plots were maintained as control. Observations on number of panicles plant^{-1}, number of seeds panicle^{-1}, 1000 seed weight and seed yield were taken in 15 plants in each experimental unit. The data were statistically analysed using AGRES software.

RESULTS AND DISCUSSION

The seeds fortified with 3 % sprouted cowpea extract recorded higher germination (80 %), shoot length (9.65 cm), root length (19.99 cm), and dry matter production (0.130 g) compated to control seed gram extract was on par with 3 % sprouted horse gram extract and control seeds (Fig.1.). The beneficial effect of sprouted pulse seed extract could be attributed to the presence of minerals *viz*., nitrogen, phosphorous, potassium, calcium, iron, zinc, soluble sugars, soluble proteins and vitamins. These findings were in conformity with the findings of Dhaliwal and Agarwal (1999). Chang and Harrold (1988) concluded that sprouting is an inexpensive and effective technology for improving the quality of legumes, by enhancing their digestibility, increasing the content of amino acids and reducing the levels of anti-nutrients. Marimuthu (2007) and Grzywnowicz-Gazda (1982) also expressed similar pronounced effect due to fortification with micronutrients.

In foliar spray; the seeds fortified with 3 % sprouted cowpea extract followed by 2 % sprouted cowpea extract sprayed at active tillering and seed filling recorded maximum number of panicles plant^{-1} (10.25), number of seeds panicle^{-1} (127), 1000 seed weight (16.02 g) and seed yield (19.16 Q ac^{-1}).The lowest was observed in control (8.72, 98, 15.34, 14.62 respectively for number of panicles plant^{-1}, number of seeds panicle^{-1}, 1000 seed weight (g) and seed yield

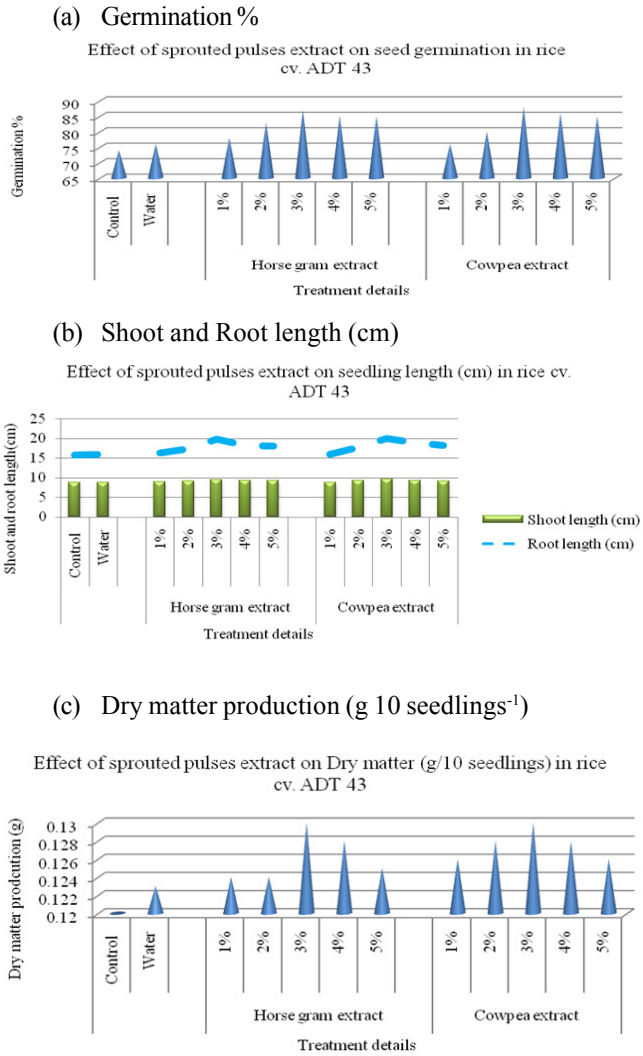

Fig. 1. Effect of seed fortification with sprouted pulse extract on rice cv. ADT 43

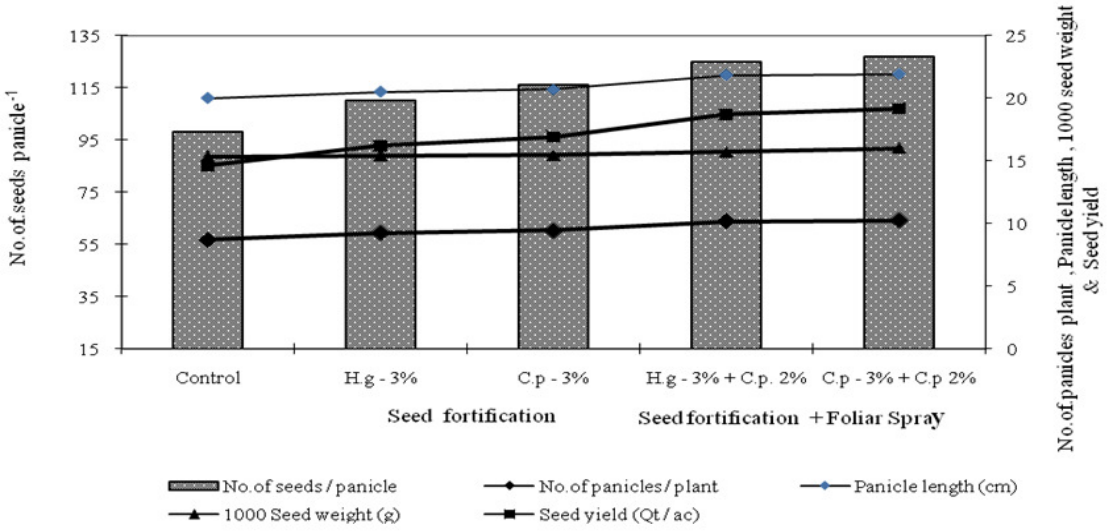

Fig. 2. Effect of seed fortification and foliar spray with sprouted pulse extract on seed yield attributes of rice cv. ADT 43

(Q ac^{-1}) (Fig.2.). Shinde and Bhilare (2003) reported even small quantities of nutrients applied through foliage 2 to 3 times at different growth stages of crops would meet out the nutrient requirements of the crops and thus productivity could be enhanced with low input cost. Foliar spray of nutrients increases the yield by reducing flower and fruit shedding and by making the plants photosynthetically more effective (Greer and Anderson, 1965). Improvement in seed weight might be due to better translocation and accumulation of food reserves on the seeds. The higher yield noticed in the effective treatments may probably be due to longer retention of the effective photo- assimilatory surface (Thorne 1973; Sekhan *et al.*, 1987). Similar effect on seed weight was reported by Balakrishnan and Natarajarathinam (1996) in rice crop sprayed with Zn. Foliar application of P at critical stages of crop growth is effectively absorbed by the crop and translocated more efficiently to the developing pods for proper filling of seeds this is very well reflected in the higher values obtained for different yield attributes (Elizabeth *et al.,* 1988).

It could be concluded that, ADT 43 rice seeds fortified either with 3 % sprouted cowpea extract or in 3 % sprouted horse gram extract followed by foliar spray with 2 % sprouted cowpea extract at active tillering and seed filling stage can be recommended to increase the seed quality, seedling vigour and the seed yield.

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