International Journal of Agriculture, Environment & Biotechnology
Citation: IJAEB: 6(1): 107-112 March 2014
DOI 10.5958/j.2230-732X.7.1.015

Agronomy

Role of Pulse Sprouts Extract Foliar Spray in Seed Yield of Paddy Cultivars

M Kokila[1], P Natesan[1] and Jeyakumar[2]

[1]Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, India
[2]Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore, India

Email: koklaks@yahoo.co.in

Paper No. 186 Received: November 18, 2013 Accepted: January 30, 2014 Published: March 03, 2014

Abstract

To evaluate the performance pulse sprout extract foliar spray, SRI method of cultivation and their interaction effect on seed yield attributes in different rice cultivars, the field experiment was conducted with split split plot design. The experiment consisted of planting method as main plot treatment [SRI (P1) with 25x25 cm spacing and Conventional (P2) with 25 x 15 cm spacing]; short duration cultivars as sub plot treatment [ADT 43 (V1), ADT 47 (V2) and IR 50 (V3)] and foliar spray as sub sub plot treatment [Pulse sprout extract (2% cowpea) spray (T1) and Micronutrients mixture spray (Zinc, Iron, Boron) (T2)]. The results revealed that all the cultivars performed better under SRI method (P1) of planting and registered maximum growth, physiological and yield attributes such as number of tillers per hill, number of leaves per hill, leaf length and breadth, dry matter production per hill, leaf area index, number of productive tillers per hill, panicle length, single ear head weight, number of seeds per panicle and 21.66 per cent increase in seed yield over the conventional method of planting. Among the foliar spray treatments, the pulse sprout extract (T1) registered 21.88 per cent increase in seed yield over foliar spray of micronutrients mixture (T2). Hence, the SRI method of planting and foliar spray of pulse sprout (2% cowpea) extract (T1) can be recommended for seed production of paddy short duration cultivars.

Highlights

- Paddy seed yield was analyzed in SRI and conventional method of planting along with foliar spray of nutrients.
- SRI performed better than t conventional method.
- As a new attempt foliar spray of 2% cowpeaextract (T1)was compared with micronutrients spray (T2).
- T1 increased 21.88 per centseed yield.

Keywords: Days after transplanting (DAT), Foliar spray of nutrients, paddy, pulse sprout extract, system of rice intensification (SRI).

Introduction

Rice (*Oryza sativa)* is the major source of food for nearly one-half of the world's population. Over 95% of the world rice crop is used for human consumption as food. With one out of every three people on earth dependent on rice as a staple food in their diet and with 80-100 million new people is added annually. India has the largest paddy output in the world and is the second largest exporter of rice in the world. The most important rice-producing countries are mainland

China, India and Indonesia, but in many smaller countries rice is the leading food crop.

The conventional method of paddy cultivation is creating demand for more water, increased cost of inputs including heavy dosage of chemical fertilizers and pesticides and less returns causing negative effect on the livelihoods of the farmers. Paddy is basically not an aquatic plant but over the years due to over stagnation of water in the paddy fields, it has developed resistance towards more water (Shekhar and Jayesh, 2007).

In present paddy cultivation method, farmers adopt unscientific methods to address some problems, which cause damage to the growth of the plant. Hence the demand for more rice has placed heavy pressure on farmers and agricultural researchers to intensify rice production systems. Due to rapid population growth and urbanization, the cultivated land is gradually decreasing, which demand increased output simply to keep pace with the population increase. This is possible only by increasing the productivity.

In rice, SRI practice facilitated larger individual plants and resulted in better light distribution, taller plants, higher base internodes, weight bearing ability, larger total area and higher plant dry weight which promote the yield. Profuse tilleringnature of SRI method of rice cultivation compensate the yield loss due to less population.Sprouting increase the bioavailability of minerals and vitamins . Plants require specific amount of certain nutrients in specific form at appropriate time for their growth and development (Sajid *et al.*, 2008).

Hence, the application of nutrient extract from the sprouted pulses in the form of foliar spray will enable better crop growth and productivity of rice.Always the foliar applications of mineral nutrients are more efficient than root application when soil conditions are not suitable for nutrients availability. Thus, the study about combination of SRI and foliar feeding of pulse sprout extractis important for rice cultivation.

Materials and Methods

The field experiment was conducted during 2010-2011 *kharif* season, at Pungar block of Agricultural Research Station (TNAU), Bhavanisagar located in the Western Zone of Tamil Nadu state (India).The experiment consisted of the main plot treatment [Planting methods: SRI (P1) with 25x25 cm spacing and Conventional (P2) with 25 x 15 cm spacing]; sub plot treatment [Short duration cultivars *viz.*, ADT 43 (V1), ADT 47 (V2) and IR 50 (V3)] and sub sub plot treatment [2% cowpea sprout extract spray (T1) and Micronutrients mixture spray (0.2% Iron, 1.0% Zinc and 0.5% Boron were pooled together) (T2)]. T1 was sprayed at 30DAT & 60DAT and T2 sprayed at panicle initiation stage.

Results and Discussion

The increased tiller density was observed in SRI method of planting. This is attributed for more spacing between the plants in SRI method of planting and might have resulted in more utilization of solar energy and nutrients, maximum photosynthetic rate and cono weeding. Conoweeding not only helped in reducing weed competition, but also improved root growth by increasing soil aeration.

The number of productive tillers per plant was maximum in SRI method of planting with younger seedlings (14 days old seedlings), compared to the planting of aged seedlings (21 days old seedlings). Similar results were also reported in rice by Hoshikawa (1992); Migo and Datta (1982). Transplanting of very young seedlings usually preserved a potential for tillering and rooting and that was reduced in transplanting of aged seedlings. The production of less number of total and productive tillers by the aged seedlings resulted in restricted growth caused by the manifestation of anatomical changes like reduced cell division and elongation and reduced absorption of nutrients (Wolswinkel, 1992).

The emergence of tillers and their development are greatly influenced by number of factors such as nutrient supply, solar radiation and temperature (Murata and Matsushima, 1975). The maximum number of tillers (22.22 tillers per hill) and fully expressed growth potential of plants were noticed in SRI method of planting. The total tillers per hill were found to be maximum (23.72 tillers per hill) in the pulse sprout extract spray (T1) followed by micronutrient mixture spray (T2) (20.55 tillers per hill) (Table 1).

Better assimilation of photosynthates due to better utilization of solar radiation might have increased the size of sink and effective translocation of assimilates, which might have lead to improved ear head weight, filled seeds panicle^{-1}. Higher translocation and conversion rates of stored matter from vegetative organs was significant importance for enhanced seed filling and spike weight in SRI rice (Wang *et al.*, 2002). Wider spacing can be one reason for reduced above-ground competition for better grain filling, higher grain weight and number of filled grains per panicle (Rajesh and Thanunathan, 2003). It is evident that the yield attributes

PRINT ISSN.: 0974-1712 ONLINE ISSN.: 2230-732X

Table 1: Total number of tillers hill^{-1} at harvest stage as influenced by planting methods, cultivars and foliar spray of nutrients for seed production in paddy.

Treatments	SRI (P1)				Conventional (P2)				Mean			
	T0	T1	T2	Mean	T0	T1	T2	Mean	T0	T1	T2	V
ADT 43(V1)	20.00	27.00	22.33	23.11	17.33	21.66	19.66	19.55	18.66	24.33	21.00	21.33
ADT 47(V2)	20.00	29.00	24.00	24.33	18.00	25.00	22.00	21.66	19.00	27.00	23.00	23.00
IR 50 (V3)	17.66	21.33	18.66	19.22	16.00	18.33	16.66	17.00	16.83	19.83	17.66	18.11
Mean	19.22	25.77	21.66	22.22	17.11	21.66	19.44	19.40	18.16	23.72	20.55	20.81

	P	V	T	P at V	P at T	V at T	P at VT
SE d	0.51	0.30	0.41	NS	0.70	0.66	NS
CD(P=0.05)	2.23	0.70	0.86	NS	2.31	1.41	NS

Treatments (T) : T0- Control, T1- 2% Cowpea pulse sproutextract , T2- Micronutrient (Zn, Fe, B) mixture.

in the present investigation were influenced by agronomic manipulations like younger seedlings, limited irrigation, wider spacing and cono weeding.

Sprouts are an extremely inexpensive method of obtaining a concentration of vitamins, minerals and enzymes. They have in them all the constituent nutrients of fruits and vegetables and are 'live' foods. Sprouting of grains for a limited period causes increased activities of hydrolytic enzymes, improvement in the contents of certain essential amino acids, total sugars, and B-group vitamins, and a decrease in dry matter, starch, and antioxidants (Chavan and Kadam,1989).

The germination of seeds produced changes in the carbohydrate fraction, mainly an increase of TDF in most instances, except for soybean, and a drastic reduction of RFOs from 98 per cent to 63 per cent, with the corresponding increase in the amounts of total soluble sugars reported by María *et al*. (2007).

Nutrients	In sprouts over dry seeds (%)
Energy content (calories)	Decrease 15
Total carbohydrate content	Decrease 15
Protein availability	Increase 30
Calcium content	Increase 34
Potassium content	Increase 80
Sodium content	Increase 690
Iron content	Increase 40
Phosphorous content	Increase 56
Vitamin A content	Increase 285
Thiamine or Vitamin B_1 content	Increase 208
Riboflavin or Vitamin B_2 content	Increase 515
Niacin or Vitamin B_3 content	Increase 256
Ascorbic acid or Vitamin C content	An infinite increase

(Mara *et al*., 2007)

Sprouting is the practice of soaking, draining and leaving seeds until they germinate and begin to sprout. It has been identified as an inexpensive and effective technology for improving the nutritional quality of cereals and grain legumes. As water is introduced, enzyme inhibitors are disabled and the seed explodes to life (Bau*et al*., 1997). The presence of micronutrients in pulse sprout extract enhanced the yield attributes of paddy plant. The presence of micronutrient deficiency made impossible for the plant to get maximum benefit from NPK fertilizer application. Micronutrients have been categorized as essential even though needed in minute amounts. Plants can not complete their life cycle in the absence of micronutrients. Addition of micronutrients in the crop production system could reduce nutrients imbalance and producing healthier plants and increased crop yields.Yassen*et al*. (2010) reported that 24 per cent seed yield increment resulted from spraying of Fe +Zn in wheat plant. The micro nutrients such as Cu, Fe and Zn (which were present in pulse sprout extract) involved in the biochemical activities and thus helped in achieving higher yields.

Traditional amendments of nutrients reduce the total chemical fertilizer required for crop (Schoenau and Davis, 2006; Bhaduri and Gautam,2012). Soil quality was affected due to more application of chemical fertilizers (Bhatt *et al.*, 2012).

The present findings revealed that SRI method of planting (P1) produced more number of productive tillers hill^{-1} (18.14) (Fig.1), panicle length (24.30 cm) (Table 2), number of seeds (138.62) per panicle, single ear head weight (43.66 g) and less number of ill filled seeds per panicle (7.70). The seed yield was also found to be significantly higher in SRI method of planting (P1) and it recorded an

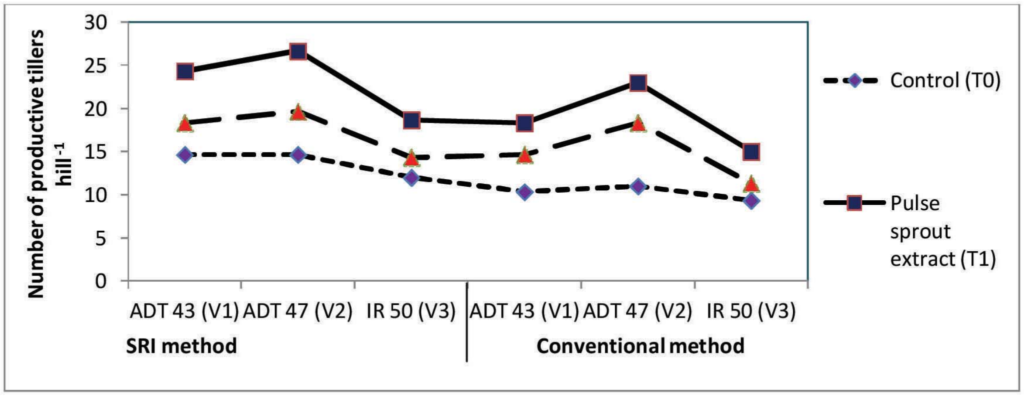

Fig. 1: Effect of planting methods, cultivars and foliar spray of nutrients on number of productive tillers per hill for paddy seed production.

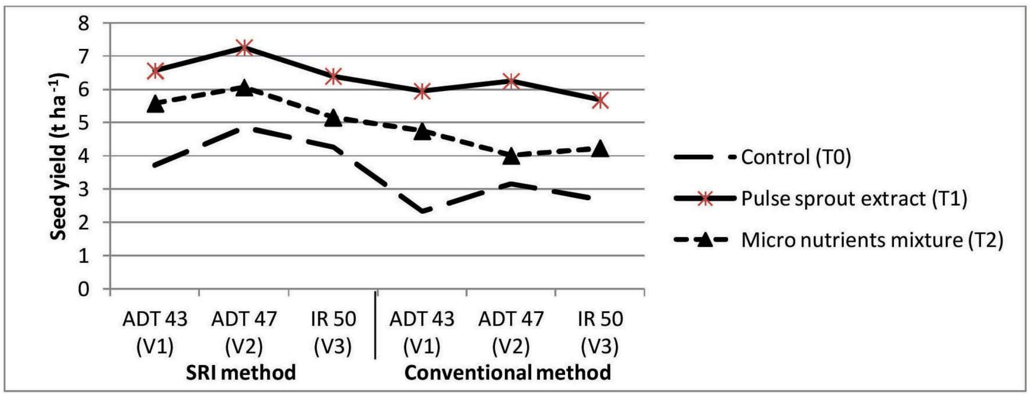

Fig. 2: Effect of planting methods, cultivars and foliar spray of nutrients on seed yield per hectare (t/ha) for paddy seed production.

Table 2: Panicle length (cm) as influenced by planting methods, cultivars and foliar spray of nutrients for seed production in paddy.

Treatments	SRI (P1)				CONVENTIONAL (P2)				Mean			
	T0	T1	T2	Mean	T0	T1	T2	Mean	T0	T1	T2	V
ADT43(V1)	23.10	25.30	24.33	24.24	22.93	25.00	23.96	23.96	23.01	25.15	24.15	24.10
ADT47(V2)	24.13	26.56	25.23	25.31	23.96	25.00	24.90	25.00	24.05	26.35	25.06	25.15
IR 50 (V3)	22.13	24.56	23.40	23.36	21.93	24.20	22.96	23.18	22.03	24.38	23.18	23.20
Mean	23.12	25.47	24.32	24.30	22.94	25.11	23.94	24.00	23.03	25.29	24.13	24.15

	P	V	T	P at V	P at T	V at T	P at VT
SE d	0.02	0.05	0.03	NS	0.04	0.06	NS
CD(P=0.05)	0.08	0.12	0.06	NS	0.10	0.15	NS

Treatments (T) : T0- Control, T1- 2% Cowpea pulse sproutextract , T2- Micronutrient (Zn, Fe, B) mixture.

yield of 5.54 tonnes per hectare over the conventional method of planting (4.34 t/ ha) (Fig.2).

The performance of all the cultivars was found to be better by recording higher seed yield when grown under SRI method of planting (planting of 14 days old seedlings from raised bed nursery, single seedling per hill with 25 x 25 cm spacing, limited irrigation on appearance of hairline cracks up to panicle initiation and mechanical weeding with conoweeder) and foliar spray with pulse sprout extract (cowpea 2%) at 30& 60 DAT and concluded that the SRI method of planting with foliar spray of cowpea 2% sprout extract can be followed for higher seed production in rice for enhancing the seed yield.

References

Bau, H.M., C. Villaume, J.P. Nicolas and L. Mejean. 1997. Effects of germination on chemical composition, biochemical constituents and anti-nutritional factors of soybean seeds. *Journal of Food Science and Agriculture* **73 :** 1–9.

Bhaduri, D., and P. Gautam. 2012. Balanced use of fertilizers and FYM to enhance nutrient recovery and productivity of wheat (Triticumaestivumcv UP-2382) in a Mollisol of Uttarakhand. *International Journal of Agriculture Environment and Biotechnology*, **5:** 435-439.

Bhatt, B., R. Chandra, and S. Ram. 2012. Long-term application of fertilizer and manure on rice productivity and soil biological properties. *International Journal of Agriculture Environment and Biotechnology* 5:429-433.

Chavan, J.K. and S.S. Kadam. 1989. Nutritional improvement of cereals by sprouting. *Food Science and Nutrition* **28(5):** 401-437.

Hoshikawa, K. 1992. Recent development in rice seedling raising in Japan with special reference to the 'nursling seedling'. *Koreon Journal of Crop Science* **37(2):** 198-208.

Maria, A., Martin-Cabrejas, Maria Felicia Diaz, Yolanda Aguilera, Vanesa Benitez, Esperanza Molla and Rosa M. Esteban. 2007. Influence of germination on the soluble carbohydrates and dietary fibre fractions in non-conventional legumes. *Journal of Food Chemistry* 1045-1052.

Migo, T.R. and S.K. D. Datta. 1982. Effect of cultivar, seedling age and nitrogen application method on weed population and grain yield in transplanted rice (*Oryza sativa*). **In:** Paper presented at the 13th Annu. Conf. Pest. Contr. Counc. Philipp**.,** 5-8.

Murata, Y. and S. Matsushima. 1975. Rice. **In**: Crop physiology. Evans, L. T. (Ed). Cambridge University press.73-100.

Obulamma, U. and Reddeppa Reddy. 2002. Effect of spacing and seedling number on growth and yield of hybrid rice. *Journal of Research ANGRAU* **30(1):** 76-78.

Rajesh, V. and K. Thanunathan. 2003. Effect of seedling age, nutrient uptake of traditional Kambamchamba rice. *Madras Agriculture Journal* **90 (1-3):** 47-49.

Sajid, A., A.R. Khan, G. Mairaj, M. Fida and S. Bibi.(2008). Assessment of different crop nutrient management practices for yield improvement.*Australian Journal of Crop Science*,**2 (3):** 150-157.

Schoenau, J.J., and J.G. Davis. 2006. Optimizing soil plant responsesto land-applied manure nutrients in the Great Plains of North America. *Canadian Journal of Soil Science* **86**:587-598.

Shekhar K.S. and T. Jayesh. 2007. Productivity impacts of the system of rice intensification (SRI): A case study in West Bengal, India.*Agricultural Water Management* **87:** 55-60**.**

Wang S.H., Cao Weixcing, Jiang Dong, Dai Tinbo and Zhu Yas. 2002. Physiological characteristics and high yield techniques with SRI rice. **In**: proceedings of an International conference on assessments of the System of Rice Intensification (SRI). Sanya, China, April 1-4, 2002.

Wolswinkle, P. 1992. Transport of nutrients into developing seeds: A review of physiological mechanisms. *Seed Science and Research* **2:** 59-73.

Yassen, A., E.A.A. Abou El-Nour and S. Shedeed. 2010. Response of Wheat to Foliar Spray with Urea and Micronutrients. *Journal of American Science* **6(9):** 14-22.

PRINT ISSN.: 0974-1712 ONLINE ISSN.: 2230-732X