Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6637

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (4):** 728-732 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of GA_3 with Organic and In-Organic Supplements in KRH-4 Hybrid Rice Seed Production

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Received: 19.06.2018 | Revised: 24.07.2018 | Accepted: 3.08.2018

ABSTRACT

A field experiment was conducted during kharif 2016 at the Agricultural Research Station, Malagi, UAS, Dharwad to study the effect of GA_3 with organic and in-organic supplements in KRH-4 hybrid rice seed production. The treatments imposed include T_1: GA_3 60 ppm, T_2: GA_3 60 ppm + NAA 50 ppm, T_3: GA_3 60 ppm + Boric acid 2%, T_4: GA_3 60 ppm + $ZnSO_4$ 0.5%, T_5: GA_3 60 ppm + Urea 2%, T_6: GA_3 60 ppm + 19 All 2%, T_7: GA_3 60 ppm + Albizia amara leaf extract 2%, T_8: GA_3 60 ppm + Panchagavya 5%, T_9: GA_3 60 ppm + Jeevamrutha 5%, T_{10}: GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5%, T_{11}: GA_3 60 ppm + Panchagavya 5% + Albizia amara leaf extract 2% and T_{12}: GA_3 60 ppm + Albizia amara leaf extract 2% + Jeevamrutha 5%. The results revealed that, among the different combinations of in-organics or organics with GA_3, the foliar application of GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5% recorded the highest number of productive tillers (9.5), highest panicle exsertion rate (84.34 %), seed set per cent (21.50 %) and seed yield per hectare (1320 kg) which was found on par with T_{11}: GA_3 60 ppm + Panchagavya 5% + Albizia amara leaf extract 2%. The study indicated that GA_3 can be supplemented with organic formulations like Panchagavya, Jeevamrutha and Albizia amara leaf extract to enhance the seed yield as well as to reduce the burden of cost of seed production.

Key words: *Hybrid Rice, GA_3, Panchagavya, Jeevamrutha, Albizia amara*

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for nearly half of the world's population. However, more than 90 per cent of rice is consumed in Asia, where it is the staple food for a majority of the population, including 560 million hungry people in the region. Globally, India ranks first in terms of area under rice whereas second in production next to China. It is also a staple food for more than 65% of the Indian population, accounts for more than 42% of food production. "Rice is life" was the theme of International year of rice, 2004 that reflects the importance of rice, which holds the key to our country's ability to produce enough food for our people.

Cite this article: Madhukeshwara, B., P. and Deshpande, V. K., Effect of GA_3 with Organic and In-Organic Supplements in KRH-4 Hybrid Rice Seed Production, *Int. J. Pure App. Biosci.* **6(4):** 728-732 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6637

The food security of India and other countries is now at risk due to increase in the population. By 2050, population of India is expected to be 1.6 billion from the current level of 1.1 billion. This implies a greater demand for food. Although, the world as a whole may have sufficient food for everyone, it would need to be produced in the region itself due to socio-economic and political compulsions. To safeguard and sustain the food security in India, it is important to increase the productivity of rice under limited resources. So the technologies followed in India need to be constantly updated to meet the challenge of food security

To sustain the self sufficiency in rice, additional production of 1.5 million tons is needed every year to meet the demand of current increasing growth rate of population explosion. Among the limited options, hybrid technology is the only proven technology currently available for stepping up rice production significantly. The Chinese scientists were the first in the world to develop commercial hybrids in rice and the first hybrid was released in 1976. While developing/evaluating hybrids, the combinations of varieties that exhibit vigour or heterotic effect for yield are selected. The rice hybrids, recently introduced in cultivation, on an average, give 10 to 15q/ha additional yield over the conventional varieties (about 20 % increase). Therefore, the introduction of hybrids and popularization of their production technology are feasible and readily adoptable to achieve targeted production. Poor exsertion of the panicle from flag leaf sheath is a problem associated with cytoplasmic male sterile lines. Foliar application of gibberellic acid (GA_3) is an essential technique in promoting panicle exsertion and obtaining high cross-pollinated seed set in hybrid rice seed production which was proven and a successful approach in significant increased seed yield in China Gavino *et al*.[2]. However the cost burden of GA_3 together with decrease in the water table affecting the preferences of the farmers to take up the hybrid rice seed production programme. Hence keeping this point in view the present investigation was under taken to identify the suitable supplements of GA_3 to promote hybrid rice seed production and make it more economical.

MATERIAL AND METHODS

The field experiment was carried out at the Agricultural Research Station Malagi, UAS, Dharwad during *kharif* 2016 to evaluate the effect of GA_3 with organic and in-organic supplements in KRH-4 hybrid rice seed production. The experiment was laid out in randomized block design with 12 treatments *viz.*, (T_1): GA_3 60 ppm, T_2: GA_3 60 ppm + NAA 50 ppm, (T_3): GA_3 60 ppm + Boric acid 2%, (T_4): GA_3 60 ppm + $ZnSO_4$ 0.5%, (T_5): GA_3 60 ppm + Urea 2%, (T_6): GA_3 60 ppm + 19 All 2%, (T_7): GA_3 60 ppm + *Albizia amara* leaf extract 2%, (T_8): GA_3 60 ppm + Panchagavya 5%, (T_9): GA_3 60 ppm + Jeevamrutha 5%, (T_{10}): GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5%, (T_{11}): GA_3 60 ppm + Panchagavya 5% + *Albizia amara* leaf extract 2% and (T_{12}): GA_3 60 ppm + *Albizia amara* leaf extract 2% + Jeevamrutha 5% and replicated thrice. The parental seeds, CRMS 32-A (male sterile line) and MSN 36-R (Restorer line) of KRH-4 hybrid rice were collected from the Zonal Agricultural Research Station, Mandya. The foliar applications of treatments were imposed at 2-5% panicle emergence stage. The five randomly selected and tagged plants from the net plot were used to record the observations. Observations on floral traits like flag leaf angle (°), angle of gloom opening (°), yield parameters like number of productive tillers, panicle length (cm), panicle exsertion rate (%), seed set (%) and seed yield plant^{-1} (g) were

recorded. The data recorded were subjected to the statistical analysis as per Panse and Sukhatme[5].

RESULTS AND DISCUSSION

Noticeable differences were witnessed with regard to floral and yield parameters due to foliar application of GA_3 in combination with different organic and in-organics. The floral traits like flag leaf angle and angle of glume opening and yield parameters number of productive tillers as well as panicle length showed remarkable variations due to foliar application of GA_3 in combination with different organic and in-organics (Table 1). Among the treatments (T_{10}): GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5% recorded the highest number of productive tillers (9.5), highest flag leaf angle (46.67 °) and higher angle of glume opening (36.67 °) which was on par with (T_{11}): GA_3 60 ppm + Panchagavya 5% + *Albizia amara* leaf extract 2% (9.33, 46.33 ° and 36.33 ° respectively), where as highest panicle length was recorded with (T_{11}): GA_3 60 ppm + Panchagavya 5% + *Albizia amara* leaf extract 2% (19.57 cm) and was found to be at par with (T_{10}): GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5% (19.43 cm). The increase in the number of tillers might be due to enhanced absorption of nutrients and presence of GA, IAA and other growth promoting substances in panchagavya as well as Jeevamrutha. The modifications in the floral traits such as increase in flag leaf angle and increase in angle of glume opening was might be because of presence of the beneficial effect of Panchagavya was mainly attributed to the presence of large quantities of IAA and GA which are physiologically active in photosynthesis and other processes Somasundaram and Singaram[9] and also increased biological efficiency of crop plants and creating greater source and sink capacities in the plant system Boomathi *et al.*[1]. The beneficial effects of jeevamrutha were reported by Palekar[4] which was attributed to huge quantity of microbial load and growth hormones in contributing the physiological effects over floral modifications. The present results are in conformity with the findings of Yadav and Lourdraj[11] in rice; Ponnuswamy *et al.*[6] in rice; Tiwari *et al,*[10] and Shiv Dayal *et al.*[8] in rice.

The combinations of different organics and in-organics with GA_3 imparted the significant differences in other yield parameters *viz.*, panicle exsertion rate, seed set per cent, seed yield per plant and seed yield per hectare (Table 2). Among the foliar application of treatment combinations, (T_{10}): GA_3 60 ppm + Panchagavya 5% + Jeevamrutha 5% recorded the highest panicle exsertion rate (84.34 %), highest seed set per cent (21.50 %), seed yield per plant (9.30 g) and seed yield per hectare (1320 kg ha^{-1}) whereas, minimum seed set per cent (18.48 %), seed yield per plant (7.87 g) and seed yield per hectare (1117 kg ha^{-1}) was recorded with (T_4) : GA_3 60 ppm + $ZnSO_4$ 0.5%. The increase in the yield attributing characters due to combinations of different organics such as panchagavya, jeevamrutha and *Albizia amara* leaf extract together with GA_3 was mainly because of the presence of plant growth promoting hormones such as IAA, GA and others Somasundaram and Singaram[9] together with growth promoting beneficial microbes and essential nutrients which induced the physiological effects Natarajan[3] such as cell elongation, floral modifications (increase in the flag leaf angle, increase in the angle of glume opening, increased duration of floret opening) and higher stigma exsertion per cent, greater source sink relationship and effective assimilation of dry matter. These results are in conformity with the findings of Prasad *et al.*[7] in rice; Ponnuswamy *et al.*[6] in rice; Shiv Dayal *et al.*[8] in rice, Yadav and Lourdraj[11] in rice.

Table 1: Effect of GA_3 with organic and in-organic supplements on productive tillers, flag leaf angle, angle of glume opening and panicle length in seed parent of KRH-4 hybrid rice

Treatments	Productive tillers	Flag leaf angle (°)	Angle of glume opening (°)	Panicle length (cm)
T_1 GA_3 (60 ppm)	8.40	44.00	33.00	18.10
T_2 (T_1+ NAA 50 ppm)	8.70	44.00	32.67	18.17
T_3 (T_1+Boric acid 2%	8.67	44.33	32.67	18.17
T_4 (T_1+ + $ZnSO_4$ 0.5%)	8.67	44.33	33.33	18.00
T_5 (T_1+ Urea 2%)	8.63	44.67	33.33	18.20
T_6 (T_1+ 19 All 2%)	8.67	44.67	33.67	18.30
T_7 (T_1+ *Albizia amara* leaf extract 2%)	8.60	45.00	34.67	18.90
T_8 (T_1+ Panchagavya 5%)	8.73	45.33	34.67	18.80
T_9 (T_1+ Jeevamrutha 5%)	8.60	46.00	35.67	18.87
T_{10} (T_1+ Panchagavya 5% + Jeevamrutha5%)	9.50	46.67	36.67	19.43
T_{11} (T_1+ Panchagavya 5% + *Albizia amara* leaf extract 2%)	9.33	46.33	36.33	19.57
T_{12} (T_1+*Albizia amara* leaf extract 2% + Jeevamrutha 5%)	9.30	46.33	37.00	19.37
Mean	**8.82**	**45.14**	**34.47**	**18.66**
S.Em±	0.19	0.33	0.45	0.25
CD (0.05)	0.55	0.96	1.31	0.73

Table 2: Effect of GA_3 with organic and in-organic supplements on panicle exsertion rate, seed set, F_1 seed yield per plant and F_1 seed yield per hectare in seed parent of KRH-4 hybrid rice

Treatments	Panicle exertion rate (%)	Seed set (%)	Seed yield per plant (g)	Seed yield per ha (kg)
T_1 GA_3 (60 ppm)	82.70	18.61	7.93	1126
T_2 (T_1+ NAA 50 ppm)	82.79	18.81	7.97	1131
T_3 (T_1+Boric acid 2%	82.98	18.83	8.00	1136
T_4 (T_1+ + $ZnSO_4$ 0.5%)	82.23	18.48	7.87	1117
T_5 (T_1+ Urea 2%)	82.33	18.82	7.97	1131
T_6 (T_1+ 19 All 2%)	82.63	18.70	8.00	1136
T_7 (T_1+ *Albizia amara* leaf extract 2%)	82.87	18.86	8.07	1145
T_8 (T_1+ Panchagavya 5%)	83.42	18.97	8.43	1197
T_9 (T_1+ Jeevamrutha 5%)	82.96	18.93	8.23	1169
T_{10} (T_1+ Panchagavya 5% + Jeevamrutha5%)	84.34	21.50	9.30	1320
T_{11} (T_1+ Panchagavya 5% + *Albizia amara* leaf extract 2%)	84.22	21.20	8.97	1273
T_{12} (T_1+*Albizia amara* leaf extract 2% + Jeevamrutha 5%)	83.97	20.81	8.83	1254
Mean	**83.12**	**19.38**	**8.30**	**1178**
S.Em±	0.60	0.46	0.27	37.71
CD (0.05)	1.78	1.36	0.79	110.07

CONCLUSION

The present investigation revealed that supplementing GA_3 with organic formulations like Panchagavya and Jeevamrutha enhanced the F_1 seed yield by 17.23 per cent over foliar application of GA_3 alone. The combination of such organic formulations is more economic and feasible with hybrid rice seed production.

Acknowledgments

The authors are thankful to the University of Agricultural Sciences, Dharwad (Karnataka), India for providing the necessary funds and facilities to undertake the present research work under Staff Research Project.

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