International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 8, Issue 42, 2016, pp.-1854-1856.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

INFLUENCE OF PLANT GROWTH REGULATORS ON THE PLANT GROWTH AND SEED YIELD OF F_1 HYBRID RICE (KRH-4)

NATARAJ K.[1]*, RAME GOWDA[1], SHIVKUMAR N.[2], YOGANANDA S.B.[2], DEVARAJU P.J.[2] AND MAHADEVU P.[2]

[1]Department of Seed Science and Technology, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bengaluru, 560065, Karnataka, India
[2]Zonal Agricultural Research Station, Mandya, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bengaluru, Karnataka, India
*Corresponding Author: Email-natarjk@gmail.com

Received: May 23, 2016; Revised: June 12, 2016; Accepted: June 16, 2016; Published: October 01, 2016

Abstract- The research on the effect of plant growth regulators on the plant growth and seed yield of F_1 hybrid rice (KRH-4) was conducted at the Zonal Agricultural Research station, VC Farm, Mandya, Karnataka during growing season's *kharif*-2012 and *rabi* /summer-2012. The experiment was laid out in Randomized Complete Block Design with planting ratios 3: 8 (male to female ratio). The treatment *viz*., T_1: GA_3 @ 100ppm, T_2: NAA @ 100ppm, T_3: GA_3 @ 50ppm + NAA @ 50ppm, T_4: GA_3 @ 100ppm + NAA @ 100ppm, T_5: GA_3 @ 25ppm and NAA @ 25ppm, T_6: KNO_3 @ 1.0 %, T_7: Urea @ 2.0 % and T_8: No foliar spray (Control) and two foliar sprays (first spray at 5 % flowering and 2nd spray one day after1st spray) were imposed only on female lines. The application of GA_3@ 100ppm give better seed yield (1981 kg/ha and 3096 kg/ha) over control 1013kg and 1285 kg/ha during *kharif* and rabi /*summer* season.

Keywords- Gibberllic acid, Hybrid rice, NAA, Sed set per cent, Seed yield

Citation: Nataraj K., et al., (2016) Influence of Plant Growth Regulators on the Plant Growth and Seed Yield of F_1 Hybrid Rice (KRH-4). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 42, pp.-1854-1856.

Academic Editor / Reviewer: R.P.S. Shaktawat, Dr Avtar Singhm, S.K. Yadav , Anita Mohanty, R.K. Mathukia, Revathi S.

Introduction

Rice (*Oryza sativa* L.) is one of the staple foods in India and is consumed by majority of population. However, lower rice yield due to lack of applying the seed technological methods, techniques and growth promoting chemicals has become an issue in terms of meeting the food need of public. Therefore, yield boosting seed technological technique such as application of certain plant growth regulators needs due attention. The plant growth regulators are synthesized indigenously in the plants and several studies result that plant can respond to exogenously applied of growth hormones and regulators. Therefore, the increase in the rice seed yield and its production in India, although future expansion of growing rice area maybe require high and costly investments, a substantial yield increase could be obtained with the wide adoption of new technology in hybrid rice production [1].

The presence of sufficient hybrid vigour is an important factor for successful of hybrid seed production in rice. In 1976, the Chinese scientists were made a crucial innovation, the successful commercializing for using the three line system for production of hybrid rice and they were succeed to raising yields to more than 5 t ha during 1983. By adapting new advanced technology, nationwide rice yields averaged more than 6 t ha by 1995 and 2004 yield of super hybrid rice cultivated in selected regions had achieved yields of more than 10 tonnes ha and can be fulfilled by 2010[2]. and hybrid rice yield during 2012 [3]. Since rice is self pollinated crop, the hybrid seed production must be based on male sterility system. Currently, the most popular male sterility system for commercial exploitation of hybrid rice technology is CMS system popularly known as the three line system. Seed production technology is a key to the successes of hybrid rice to enhance the efficiency of hybrid seed production, it is necessary to increase the yield of hybrid seed by improving the out crossing capacity of CMS lines [4]. Auxins (NAA) and other gibberellins being well known plant growth promoting hormones has shown to be involved in a variety of plant growth and development processes. Auxins may regulates cell elongation, tissue swelling, cell division, formation of adventitious roots [5,6]. Gibberellic acid is responsible for stimulating the production of m-RNA molecules in the cells and these m-RNA produced in this form codes for the hydrolytic enzymes, which in turns improve the chance of fast growth and development [7]. Growth regulators are showed to improve effective partitioning and translocation of accumulates from source to sink relation in the field crops. Hence the present investigation was carried out to study the influence of plant growth regulators on the plant growth and seed yield of hybrid rice KRH 4.

Materials and Methods:

The research on the effect of plant growth regulators on the plant growth and seed yield of F_1 hybrid rice (KRH-4) was conducted at the Zonal Agricultural Research Station, VC Farm, Mandya, Karnataka during different growing seasons *viz*,. *Kharif-2012* and *rabil summer*-2012. The experiment was laid out in Randomized Complete Block Design with planting ratio 3: 8 (male to female ratio). Treatments were imposed only on female lines by two foliar spray, first spray at 5 % flowering and 2ndspray one day after 1stspray. The treatment were, T_1: GA_3 @ 100ppm,T_2: NAA @ 100ppm, T_3: GA_3 @ 50ppm + NAA @ 50ppm, T_4: GA_3 @ 100ppm + NAA @100ppm ,T_5: GA_3 @ 25ppm and NAA @ 25ppm, T_6: KNO3 @ 1.0 %, T_7: Urea @ 2.0 % and T_8: No foliar spray (Control). The seeds of CRMS32A (A) and MSN36 (R) obtained from the Zonal Agricultural Research Station, VC Farm, Mandya, Karnataka, India used for study. The seedlings of both female and male parents were raised on wet bed nursery. The seeds of female parent were sown on single day and that of male parent sown five and eight days earlier to the female parent. The seedlings were transplanted when they attained 28 days. The planting was done in different ratios of female and male parent. The spacing of 15cm between plants of both female and male parent and 15cm between rows was followed. Single seedling of female and two seedlings of male parent were planted per hill

and recommended fertilizer dose of 100:50:50 N, P_2O_5, K_2O kg ha^{-1} was applied. Out of this, 50kg N and entire dose of P_2O_5 and K_2O were applied at the time of planting and the remaining 50kg N was applied in two equal split doses, one at tillering and another at panicle initiation stage. Observations were recorded on plant growth and yield parameters were recorded on five randomly selected plants in each treatment.

Results and Discussion

The plant height differed significantly due to treatments with plant growth regulators in F_1 hybrid seed production of KRH-4 during *kharif* 2012 and *rabi/summer* 2012 [Table-1&2]. In general, the original plant height of R line is higher than A line and the sensitivity of R line to GA_3 is stronger than A line also. The foliar spray increased the plant height significantly over control. The treatment GA_3 @ 25ppm+ NAA @ 25ppm recorded higher plant height (81.90 cm) and lowest plant height were registered in Control (68.83 cm) during *rabi /summer* 2012. The plant height was also significantly higher with GA_3 @ 50ppm + NAA @ 50ppm as against lowest recorded in control (75.10 cm) during *kharif* 2012. The increase in the plant height is due to applying of plant growth regulators and hormones was promoted vegetative growth by active cell division, cell enlargement and cell elongation and these helped in improving growth traits and also facilitated reproductive growth [8] these finding were in strictly agreement with results of [9-11]. Days to 50 per cent flowering was not significant due to seasons and treatments which ranged from 91–93 days in both the seasons. Significant variation was observed in number of tillers/plant during *kharif* 2012 but it was non-significant during rabi /summer 2012. The number of effective tillers per plant as believed to be closely associated with seed yield per plant resulting high productivity. Hybrid rice relies mainly on tillers to obtain the desirable population, whereas conventional rice relies on number of seedlings planted. The significantly differed with number of tillers per plant and maximum number of tillers per plant were recorded (9.47)with spraying of Urea @ 2.0 % and control was recorded lowest number of tillers (7.87) during *kharif* 2012,however there was non significant difference between the treatments during *rabi/summer* 2012. The number of productive tillers per plant was significantly differed in both seasons. Higher number of productive tillers was noticed with GA_3 @ 100ppm + NAA @100ppm (8.87) followed by GA_3 @ 100ppm (8.67) and lower number of productive tillers was registered in control (7.53) during *kharif* 2012. Further, in *rabi/summer* 2012, significantly higher productive tillers were recorded in GA_3 @ 100ppm (13.90) followed by NAA @ 100ppm(13.47), Urea @ 2.0 % (13.00) and it was very low in No foliar spray control (8.53) during *rabi /summer* 2012. The filled spikelets per panicle increased in all the treatment over control. Number of filled spikelets were more in GA_3 @ 100ppm(43.10) followed by GA_3 @ 50ppm + NAA @ 50ppm(41.47) and lower was recorded in control (28.47) during *kharif* 2012 and showed increased trend in GA_3 @ 100ppm (49.97) compared to control (29.40) during *rabi/summer* 2012. Generally, larger panicle is with high number of grains panicle resulting into higher productivity, these results were in accordance [11].

Table-1 *Influence of plant growth regulators on growth attributes in hybrid rice KRH-4 during different seasons*

Treatments	Plant height (cm)		Days to 50 % flowering		No. of tillers / plant		No. of productive tillers/ plant		No. of filled spikelets/panicle	
	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012
T_1- GA_3 @ 100ppm	81.73	77.90	93.33	92.00	8.93	14.23	8.67	13.90	43.10	49.97
T_2 - NAA @ 100ppm	78.53	77.03	92.33	92.67	8.60	13.47	8.33	13.47	34.30	32.37
T_3 - GA_3 @ 50ppm + NAA @ 50ppm	84.37	76.73	92.67	91.00	8.00	12.93	7.60	12.93	41.47	36.00
T_4 - GA_3 @ 100 ppm + NAA @100ppm	83.17	81.20	93.00	93.00	9.00	12.40	8.87	11.40	41.23	41.10
T_5 - GA_3 @ 25ppm + NAA @ 25ppm	80.17	81.90	93.33	91.67	9.00	11.87	8.60	11.87	39.00	34.67
T_6 - KNO_3 @ 1.0 %	77.07	76.57	93.00	92.00	7.93	11.33	7.50	11.33	35.37	42.47
T_7 - Urea @ 2.0 %	76.20	73.40	93.00	91.33	9.47	12.67	8.27	13.00	33.83	33.33
T_8 - No foliar spray (Control)	75.10	68.83	94.00	94.33	7.87	12.13	7.53	8.53	28.47	29.40
Mean	79.54	76.70	93.08	92.25	8.60	12.63	8.17	12.05	37.10	37.41
S.Em ±	0.65	1.12	0.41	0.59	0.09	0.60	0.12	0.50	0.68	1.59
CD (p=0.05)	1.98	3.39	NS	NS	0.30	NS	0.36	1.52	2.07	4.83

Significant variation in panicle length were observed during *rabi/summer* 2012, it was higher in GA_3 @ 100ppm (24.84 cm) followed by GA_3 @ 100ppm + NAA @100ppm (20.10 cm), GA_3 @ 50ppm + NAA @ 50ppm (19.16 cm) and over control (16.13 cm). During *kharif* 2012, the panicle length did not show significant variation in treatments and these results were in conformity with results of [12]. The data on panicle exertion per cent age showed significantly in both seasons. Higher panicle exertion was recorded in GA_3 @ 100ppm (88.46%) followed by GA_3 @ 50ppm + NAA @ 50ppm(87.55) and GA_3 @ 100ppm + NAA @ 100ppm (86.94) but control (79.47%) was recorded lower value during *kharif* 2012. During *rabi / summer* 2012, the maximum panicle exertion was observed in GA_3 @ 100ppm (90.32%) followed by KNO_3 @ 1.0 %, (88.60%), NAA @ 100ppm (87.96%),GA_3 @ 100ppm + NAA @100ppm (86.66) that were on par each other control (79.47%) was recorded lower value [Table-2]. The seed setting per cent was significantly differed both seasons. Superior seed seeting per cent age were recorded in GA_3 @ 25ppm and NAA @ 25ppm (21.80) on par with GA_3 @ 100ppm + NAA @100ppm ,T_5: GA_3 @ 25ppm and NAA @ 25ppm,GA_3 @ 100ppm + NAA @100ppm (21.40) and over control (16.98%) during *kharif* 2012 and same trend was noticed during rabi /summer, higher seed setting were registered in GA_3 @ 100ppm (24.84%) followed by KNO3 @ 1.0 % (20.62), GA_3 @ 50ppm + NAA @ 50ppm (19.16) and lower seed setting were noticed in control (16.25). These results were in conformity with a number of workers such as [15,16]. The seed yield is very complex trait, it is multiplicative end product of several basic components of yield such as panicle length, panicle excretion, productive tillers in hybrid rice seed production seed yield mainly depends on floral traits of CMS line and also agro morphological traits of pollen parents. The F1 hybrid seed yield per plant was significantly differed during *kharif* 2012 and *rabi/summer* 2012. The higher seed yield per plant (g) was observed with GA_3 @ 100ppm (12.03 & 13.47) during kharif and rabi/ summer seasons, but it was lower in control (6.14 & 9.88) during kharif and rabi/ summer seasons respectively. This result was supported with [12] observed up to 50 % increase in grain yield over control.

The significantly higher seed yield per hectare was registered with GA_3 @ 100ppm (1981 kg) followed by GA_3 @ 100ppm + NAA @100ppm (1545 kg/ha), GA_3 @ 25ppm and NAA @ 25ppm (1477 kg/ha) and lower seed yield in control (1013 kg) during *kharif* 2012. Besides, and also significantly higher seed yields were obtained in GA_3 @ 100ppm (3096 kg) followed by GA_3 @ 100ppm + NAA @100ppm (2635kg/ha), GA_3 @ 50ppm + NAA @ 50ppm (2434 kg) and lowest was seen in Control (1285 kg) during *rabi/summer* 2012. The increase in seed yield with application of plant growth regulators due to active translocation of photosynthesis and mobilization of reserve food materials in plant and to the developing sink by the increasing development of hydrolyzing and oxidizing enzyme activities and leads to increase seed yield [17]. And many researchers studied that, the application of plant growth regulators supplied by exogenously and was observed that increase seed yield due to undergo several metabolic processes in the soil resulting in loss of their activity and reduced availability to plants and these type of behavior were only seen with application of IAA and

gibberellic acid. These results were in conformity [19,14,4].

Table-2 *Influence of plant growth regulators on seed yield attributes in hybrid rice KRH-4 during different seasons.*

Treatments	Panicle length(cm)		Panicle exertion (%)		Seed setting (%)		Seed yield/ plant (g)		Seed yield (kg/ha)	
	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012	Kharif 2012	Rabi/summer 2012
T_1- GA_3 @ 100ppm	23.80	24.84	88.46	90.32	20.00	24.84	12.03	13.47	1918.92	3096.00
T_2 - NAA @ 100ppm	22.17	17.04	86.55	87.96	18.26	17.04	8.39	10.48	1099.10	1961.00
T_3 - GA_3 @ 50ppm + NAA @ 50ppm	23.77	19.16	87.55	84.19	20.63	19.16	8.06	10.82	1134.23	2434.00
T_4 - GA_3 @ 100 ppm + NAA @100ppm	22.63	20.10	86.94	86.66	21.40	20.10	11.22	12.83	1545.05	2635.67
T_5 - GA_3 @ 25ppm + NAA @ 25ppm	21.93	18.67	85.10	84.99	21.80	18.67	7.43	10.11	1477.48	1961.00
T_6 - KNO_3 @ 1.0 %	22.13	20.62	84.73	88.60	18.46	20.62	8.19	10.38	1076.58	2164.00
T_7 - Urea @ 2.0 %	20.70	16.77	86.62	84.48	16.98	16.77	7.47	10.01	1076.58	1962.00
T_8 - No foliar spray (Control)	19.97	16.13	83.50	79.47	15.91	16.25	6.14	9.88	1013.51	1285.67
Mean	22.14	19.17	86.18	85.83	19.18	19.18	8.62	11.00	1292.88	2187.42
S.Em ±	0.63	0.68	0.62	1.08	0.43	0.69	0.12	0.29	0.51	0.16
CD (p=0.05)	NS	2.08	1.82	3.27	1.31	2.09	0.35	0.91	1.52	0.48

Conclusion

The application of plant growth regulators (PGR's) particularly GA_3 was very effective chemicals for increasing plant growth and yield attributes such as plant height, panicle excretion, number of tillers, number of productive tiller, and seed set(%)and seed yield during *kharif*-2012 and *rabi*/*summer*-2012. The dosage of GA_3 @ 100ppm was found that the most effective and economical treatment for seed production and recommended for hybrid rice KRH-4 seed production.

Acknowledgement

The thankful for financial assistance by University Grants Commission, Govt. of India, New Delhi under Rajiv Gandhi National fellowship (F1-17.1/2011-12/RGNF-SC-KAR-9782) and greatful to my advisory chairman Dr. Rame Gowda, Special Officer (Seeds), NSP, UAS, GKVK Bangalore for giving technical guidance and support during my studies and also thankful to Dr. N. Shivakumar, Breeder (Hybrid Rice) for providing field facilities at ZARS, VC Farm, Mandya.

Conflict of Interest: None declared

References

[1] Nguyen N.V. (2010) Los Bancos, Philippines. Pp. 9-24.
[2] Li Gh, Xue L.H., Gu W., Wang S.H., Ling Q.H., Qin X., Ding Y.F. (2009) *Field Crops Res.,* 112, 214-221.
[3] Subba Rao L.V., Chaitanya U., Shobha rani N. and Viraktamath B. C. (2013) *XVIII Annual Group Meeting of AICRP-NSP,PAU, Luduiana* during 27-29th April 2013:1-9.
[4] Shi-Hua Y.C., Ben-YI W., Jian-LI, Wei-Feng S. and Shi-Hua C. (2006) *Rice Sci.,* 13,1-8.
[5] Azad M.A.K., Yokota S., Yahara S. and Yoshizawa N. (2004) *Asian j. plant sci,* 3, 522-528.
[6] Woodward A.W. and Bartel B. (2005) *Ann. Bot*., 95, 707-735.
[7] San T. (2004) Klkuwer Academic Publ., Dordreht. The Netherlands, pp: 304-320.
[8] Pareek N., Jat K. and Pareek R.G. (2000) *Haryan J. Agron*., 16,104-109.
[9] Tiwari D. K., Pandey P., Giri S.P., Dwivedi J.L. (2011) *Asian Journal of Plant Sciences*, 10(2), 133-139.
[10] Viramani S.S., Mao C.X., Toledo R.S., Hossain M. and Jannaiah A., (2007) http://www.agent.org/library/tb/156/tbl56.pdf.
[11] Bakhsh I.U., Awan M., Niamatullah K.U., Zama S. Ramzan and Khan E.A. (2012) *J. Animal and Plant Sci.,* 22(1),169-174.
[12] Elankavi S., Kuppuswamy G., Vaiyapuri V. and Raman R. (2009) *Oryza,* 46, 310-313.
[13] Kalavathi O., Anthakalaiselvi A. and Vijay J. (2000) *Seed Res.,* 28, 10-12.
[14] Yogeesha H.S., Pandey S. and Sharma S.P. (2000) *Seed Res*., 28, 87-89.
[15] Gavino B.R., PI Y. and Abon JR. C.(2008) *J. of Agri. Technol.,* 4(1),183-192.
[16] Jagadeeshwari P., Sharma S.P., and Dadlani M. (2004) *Seed Sci. & Technol.,* 32, 473-483.
[17] Elankavi S., Kuppuswamy G., Vaiyapuri V. and Raman R. (2009) *Oryza,* 46, 310- 313.
[18] Jayachandra M., Gopal N.O. and Marimuthu R. (2000) *Madras Agric.,* 89, 462-465.
[19] Zahir A.Z., Iqbal M., Arshad M., Naveed M. and Khalid M. (2007) *Pak. J. Bot*, 39, 761-768.
[20] Thangaraj M.M., Laxmprabha and Devi D.D. (2000) *Oryza*, 87, 49-50.