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MAXIMIZING *RABI* RICE PRODUCTION THROUGH FOLIAR NUTRITION

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ABSTRACT

An experiment was conducted at ACandRI, Killikulam to maximize the *rabi* rice production through foliar nutrition of plant growth regulators and nutrients during 2011-2012. The experiment was laid out in randomized block design with 16 treatments and replicated thrice. The result revealed that foliar spray of Triacontanol 2 ppm + Cytokinin 10 ppm + Polyfeed 1% + KCl 1% given at 35 and 65 DAT along with application of recommended dose of fertilizer increased all growth and yield attributes *viz*., plant height (96.1 cm), leaf area index (5.20), chlorophyll content (1.75 mg g^{-1}), dry matter production (13959 kg ha^{-1}), number of productive tillers (548), panicle length (23.8 cm) and decreased sterility percentage (12.5%). Further, the same treatment recorded higher grain yield of 6200 kg ha^{-1} and straw yield of 6950 kg ha^{-1}. It has been learned through this study, to maximize rice production in *rabi* season, foliar application of Triacontanol 2 ppm+ Cytokinin 10 ppm + Polyfeed 1% + KCl 1%" to be applied at 35 and 65 DAT along with recommended dose of fertilizer is a viable nutrient management package.

INTRODUCTION

Rice (*Oryza sativa* L.) is staple food of a millions of people in the world particularly in developing countries. About 90 per cent of rice grown in the world is produced and consumed in Asian countries (Patel *et al*., 2016). India rank first in respect of area (44.50 million ha) second in production (102.75 million tonnes), but the productivity of rice is very low (2.20 t ha^{-1}) (Verma *et al*., 2015). Rice productivity level could not be maintained because of significant control exercised by seasons. When compared to rice grown under summer season (4792 kg ha^{-1}), the yield of *rabi* season rice is much lower (3939 kg ha^{-1}) and this could be attributed to lower level of solar radiation and decreased temperature pertaining during *rabi* season (GOTN, 2012). Under low light conditions, the crop suffered due to higher sterility, which accounted for low yields during *rabi* season.

physiological efficiency including photosynthetic ability of plants and offer a significant role in realizing higher crop yields. Though, the PGR have great potential, its application and accrual assessments *etc*., have to be judiciously planned in terms of optimal concentration, stage of application and seasons (Hanchinamath, 2005). Nutrients also have important role in plant metabolism, growth and developmental processes and helps in increasing the biomass production and yield (Koler, 2008).

In this content, a field experiment was conducted to maximize the production of *rabi* season rice through foliar nutrition of plant growth regulators and nutrients with the objective of evolving best PGR and nutrient foliar spray combination for *rabi* rice on their growth and productivity.

MATERIALS AND METHODS

The field experiment was conducted at Agricultural College and Research Institute, Killikulam during *rabi* 2011-12. The experimental site is geographically located in the southern part of Tamil Nadu at 8°46' N latitude and 77° 42' E longitudes at an altitude of 40 meters above mean sea level. The soil of the experimental area was sandy clay loam in texture with low available nitrogen (Kjeldahl method) and high in phosphorus (Olsen's method) and high in potassium (Flam photometric method) contents and was neutral in reaction with 7.0 pH (Potentiometric method).The experiment was laid out in randomized block design and replicated thrice. Rice variety ADT (R) 47 with the duration of 118 days was used as the test variety. Experiments consisting 12 treatments comprised of combination of plant growth regulators and nutrients *viz*., $T_{1:}$ Triacontanol 2 ppm + Cytokinin 10 ppm + Polyfeed 1% + KCl 1%, T_2: T_1 (except KCl), T_3: T_1 (except polyeed), T_4 : T_1 (except cytokinin), T_5 : T_1 (except cytokinin and KCl), T_6 : T_1 (except polyfeed and KCl), T_7 : T_1 (except cytokinin and polyfeed), T_8 : T_1 (except Triacontanol), T_9 : T_1 (except Triacontanol and KCl), T_{10} : T_1 (except Triacontanol and polyfeed), T_{11} : T_1 (except Triacontanol and cytokinin), T_{12} : Triacontanol 2 ppm, T_{13} : Cytokinin 10 ppm, T_{14} : Polyfeed 1%, T_{15} : KCl 1%, T_{16} : control *i.e*., no foliar spray. Foliar spray of plant growth regulator and nutrient was done at 35 DAT and 65 DAT as per the treatment schedule. Blanket recommendation of 150:50:50 kg NPK ha^{-1} were applied common to all the treatments. The method of Arnon (1949) was followed for estimating chlorophyll content. The LAI of rice was worked out at tillering and flowering stage as per the method proposed by Palanisamy and Gomez (1974), using the formula as given below.

$$LAI = \frac{L \times B \times K \times \text{No.of green leaves per hill}}{\text{Spacing (Square cm)}} \times 100$$

Where,

L = Maximum length of 3rd leaf blade from the top (cm)

B = Maximum breadth of the same leaf (cm)

K = Constant factor (0.73)

Spikelet sterility is ratio of unfilled grains to the total number of spikelet's present in the panicle of each plant and expressed as per cent. The various biometric observations, analytical data of plant sample and the computed data were subjected to statistical scrutiny as per the procedures given by (Gomez and Gomez, 1984). The treatment differences were worked out at five per cent probability level.

RESULTS AND DISCUSSION

Effect of foliar spray on growth characters

A significant difference in plant height at different growth stages was observed due to the different foliar application of plant growth regulators and nutrients (Table 1). At harvest the plant height, LAI and DMP were significantly higher with application of Triacontanol 2 ppm + Cytokinin 10 ppm + Polyfeed 1% + KCl % which was followed by Triacontanol 2 ppm + Polyfeed 1% + KCl 1% . Improvement in growth parameters was due to triacontanol might be ascribed to higher photosynthetic efficiency and rapid increase in net assimilation rate. Cytokinin also regulate cell division and translocation of assimilates and thereby affects the growth parameters of rice (Anandha Krishnaveni *et al.*, 2001). Foliar spray of Polyfeed increases the plant height by supplying of more primary and micronutrients at tillering and flowering stages (Naik *et al.*, 2002). Similar findings were reported by Pandey *et al.* (2001) and Alfred *et al.* (2011).

The chlorophyll content was higher in T_2 due to foliar spraying of triacontanol and cytokinin which delayed the chlorophyll loss from the flag leaf. This delays the leaf senescence and allows more energy through higher N uptake by the crop leads to increase in grain protein content (Alfred *et al.*, 2011).

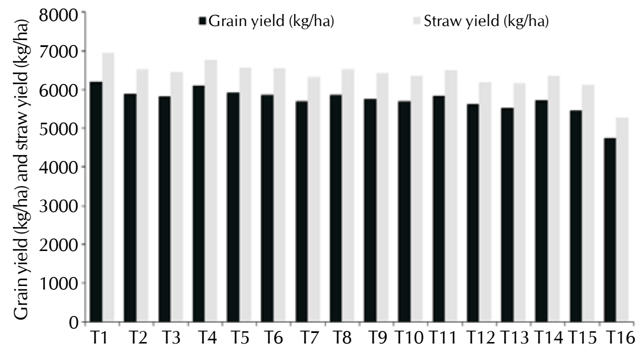

Figure 1: Effect of foliar spray of plant growth regulators and nutrients on yield and net return of *rabi* rice

Effect of foliar spray on yield attributes and yield

Foliar application of plant growth regulators and nutrients combination significantly influenced the yield components (Table 1). Triacontanol 2 ppm + Cytokinin 10 ppm + Polyfeed 1% + KCl 1% spray at different stages increased the productive tillers (548 no. /m^2) and lowered the sterility percentage (12.5%) of rice. This may be due to Triacontanol and Cytokinin reduces leaf senescence in rice by maintaining succinic dehydrogenase, there by increasing the number of productive tillers $plant^{-1}$ (Pandey *et al.*, 2001) and foliar spaying of PGR and nutrients effectively absorbed by the plant and translocated more efficiently to the developing panicles, aiding in proper filling of the grain. This statement was also supported by Abdi *et al.* (2002).

The enhancement of yield components through input management should pave the way for maximization of rice grain yield. Foliar application of Triacontanol 2 ppm + Cytokinin 10 ppm + Polyfeed 1% + KCl 1% recorded the

Table 1: Effect of foliar spray of plant growth regulators and nutrients on plant growth and yield parameters of *rabi* rice

Treatments	Growth parameters Plant height (cm)	Dry matter production (kg ha^{-1})	Leaf area index	Chlorophyll content (mg g^{-1})	Yield parameters No. of productive tillers m^{-2}	Panicle length (cm)	Sterility percentage
T_1	96.1	13959	5.2	1.75	548	23.8	12.5
T_2	91.3	13180	4.95	1.66	489	21.2	15.6
T_3	90.5	12990	4.81	1.58	453	19.7	17.2
T_4	92.8	13957	5.1	1.72	540	22.8	13.4
T_5	92	13270	5	1.7	507	21.9	14.8
T_6	91.1	13150	4.9	1.63	479	20.5	17.1
T_7	88.7	12900	4.55	1.48	433	19	18.7
T_8	89.7	13306	4.72	1.55	472	19.8	17.2
T_9	89.3	12950	4.65	1.52	442	19.2	18.1
T_{10}	88.1	12985	4.35	1.44	432	18.5	19.5
T_{11}	90.9	12400	4.86	1.6	470	19.8	18.2
T_{12}	87.9	12400	4.3	1.38	416	18.1	21.9
T_{13}	86.7	11200	4.22	1.34	411	17.8	23.7
T_{14}	88.9	12458	4.6	1.5	426	19.1	17.5
T_{15}	85.7	11900	4.21	1.32	396	17.6	24.5
T_{16}	83.7	10225	4.12	1.2	331	16	27.4
SEd	4.9	490	0.25	0.06	22	0.8	1.5
CD (p=0.05)	9.9	1000	0.51	0.13	45	1.6	3

highest grain yield (6200 kg ha^{-1}) as well as straw yield (6950 kg ha^{-1}). Plant growth regulators of triacontanol and cytokinin application in plants shows higher photosynthetic efficiency and enhanced source to sink relationship of the plant, increased uptake of nutrients and water, enhanced translocation and accumulation of sugar and other metabolites. This might be the reason for increase in the grain and straw yield of rice (Sharma and Brar, 2008 and Aikins *et al*., 2010).

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