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EFFECT OF GROWTH REGULATORS ON PRODUCTIVITY IN SAMBA AND THALADI RICES

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ABSTRACT

Experiments were conducted to evaluate and indentify suitable growth regulators to enhance the productivity of rice during the samba and thaladi seasons at the Tamil Nadu Rice Research Institute, Aduthurai using popular rice varieties grown in these seasons. Among several growth regulators tested, irrespective of the variety, foliar spray of Kinetin 20 ppm at heading following by GA_3 25 ppm at panicle initiation and tender coconut water 2% (v/v) at panicle initiation and heading were found to significantly increase the total dry matter, panicle number, grain filling and grain yield by delaying leaf senescence. The increase in grain yield ranged from 8.6 to 30% over control. Considering the cost factor, foliar spray of coconut water appears promising and could be used as a cheaper substitute for kinetin.

KEY WORDS : Rice, Productivity, Growth regulators.

In the cauvery delta region of Tamil Nadu, 70-80% percent of rice is grown only during samba and thaladi seasons (monsoon season : August-January). The major constraints for rice productivity in the samba and thaladi seasons are low light intensity, coupled with low photosynthetic reduction, panicle sterility due to incomplete panicle exsertion and inefficiency of chloroplast pigments. Partial or nonfilling of spikelets during development is a serious impediment in increasing the grain yield. The yield level can be futher raised if the problem of sterility is successfully solved. Besides environmental factors (Satake, 1976) and

Table 1. Effect of growth regulators on panicle number, total chlorophyll content, filled grains, total dry matter (TDM) and grain yield of Samba rice (Variety : CR 1009)

Treatments	Panicles per m^2 (No.)	Total Chlorophyll (mg/g fresh weight)	Filled grains (%)	TDM per hill (g)	Grain yield (t/ha)	Per cent increase over control
1. Control	381	2.884	82.2	54.8	5.73	-
2. Water spray at panicle initiation (PI)	361	2.461	83.5	53.6	5.97	4.2
3. Water spray at PI and heading	401	2.491	83.7	54.9	6.11	6.6
4. GA_3 25 ppm at PI	411	3.891	84.7	55.6	6.55	14.3
5. Miraculan 250 ppm at PI and heading	358	2.445	83.7	56.0	6.14	7.2
6. Mixtalol 2 ppm at PI and heading	361	2.335	84.0	55.2	5.82	1.6
7. Kinetin 20 ppm at heading	456	4.141	91.0	61.7	7.07	23.4
8. Tender Coconut water 2% (v/v) at PI and heading	442	4.229	86.0	59.5	6.47	12.9
CD (0.05)	25.6	0.130	3.1	1.4	0.36	

genotypic deficiencies (Islam, 1977), the endogenous growth hormones Chatterjee *et al.*, 1976; Mounla, 1978; Singh *et al.*, 1984) are also known to regulate the grain filling of some cereals. It is also possible to control the sterility in rice by improving the panicle exsertion by the application of growth regulators such as Indole acetic acid, gibberellic acid and kinetin (Singh *et al.*, 1984). Hence it was proposed to study the effect of certain growth regulators on the productivity of a few rice varieties popularly grown during the samba and thaladi seasons of the cauvery delta zone of Tamil Nadu.

MATERIALS AND METHODS

The experiments were conducted during samba and thaladi seasons of 1986-87 at the Tamil Nadu Rice Research Institute, Aduthurai. Long duration cultivar (155-160 days) CR 1009 was used as a test variety during the samba season, while medium duration (135-140 days) strains *viz.*, Co 43, Ponni, White Ponni and ADT 38 were studied during thaladi season. Thirty day old seedlings were planted in 5 x 4 m plots with a spacing of 20 x 15 cm for the variety CR 1009 where as 20 x 10 cm spacing was adopted for rest of the varieties. The varieties were raised under optimum conditions of irrigation, nutrient supply and plant protection measures in the field. The concentrations of growth regulators that were used were selected from preliminary experiments for standardization. The experiments were carried out in a randomised block design with four replications.

Aqueous solutions of growth regulators were used for spraying. The treatments were given at appropriate growth stages of the crop as indicated below. 1. Control (unsprayed) 2. Water spray at panicle initiation, 3. Water spray at panicle initiation and heading, 4. GA_3 25 ppm at panicle initiation, 5. Miraculan 250 ppm at panicle initiation and heading, 6. Mixtalol 2 ppm panicle initiation and heading, 7. Kinetin 20 ppm at heading, 8. Tender coconut water 2% (v/v) at panicle initiation and heading. Tender coconut water was included in the

Table 2. Effect of growth regulators on panicle number, total chlorophyll content and filled grains of thaladi rice varieties

Treatments	Co 43			Ponni			White Ponni			ADT 38		
	Panicles per m^2 (No.)	Total Chloro-phyll (mg/g fresh weight)	Filled grains (%)	Panicle per m^2	Total chloro-phyll (mg/g fresh weight)	Filled grains (%)	Panicle per m^2	Total chloro-phyll (mg/g fresh weight)	Filled grains (%)	Panicle per m2	Total chloro-phyll (mg/g fresh weight)	Filled grains (%)
1. Control	320	3.16	79	290	3.14	79	297	3.04	80	328	3.13	80
2. Water spray at panicle	330	3.09	80	280	3.03	78	292	3.13	81	335	3.05	79
3. Water spray at PI and heading.	324	3.09	80	284	3.04	78	283	3.17	79	298	3.07	78
4. GA_3 25 ppm at PI	352	3.58	86	316	3.57	83	326	3.53	85	358	3.41	84
5. Miracuian 250 ppm at PI and heading.	317	3.16	80	288	2.94	79	296	3.10	79	336	3.13	80
6. Mixtalol 2 ppm at PI and heading	326	3.14	80	291	2.99	80	289	3.03	77	335	3.09	81
7. Kinetin 20 ppm at heading	355	4.70	89	344	4.55	86	349	4.58	88	370	4.50	90
8. Tender Coconut Water 2% (v/v) at PI and heading.	345	3.99	85	324	3.72	82	370	3.48	84	348	3.83	85
CD (0.05)	20.1	0.28	2.4	20.1	0.28	2.4	20.1	0.28	2.4	20.1	0.28	2.4

Table 3. Effect of growth regulators on Yield Components Of Thaladi rice varieties

Treatments	Co 43			Ponni			White Ponni			ADT 38		
	TDM per hill (g)	Grain yield (t/ha)	Percent increase over control	TDM per hill (g)	Grain yield (t/ha)	Percent increase over control	TDM per hill (g)	Grain yield (t/ha)	Percent increase over control	TDM per hill (g)	Grain yield (t/ha)	Percent increase over control
1. Control	36.6	5.08	-	39.4	4.24	-	38.6	4.84	-	37.4	4.99	-
2. Water spray at panicle	37.0	5.27	3.7	39.1	4.46	5.2	37.6	4.78	-	36.7	5.03	0.8
3. Water spray at PI and heading.	37.1	5.34	5.1	38.0	4.70	10.9	37.5	4.78	1.7	37.4	5.17	3.6
4. GA_3 25 ppm at PI	40.3	5.82	14.6	40.8	5.06	19.3	40.8	5.68	17.4	40.4	5.42	8.6
5. Miraculan 250 ppm at PI and heading.	37.9	5.32	4.7	38.9	4.39	3.5	37.8	5.04	4.1	37.3	5.13	2.8
6. Mixtalol 2 ppm at PI and heading	38.1	5.20	2.4	39.1	4.28	0.9	37.6	5.06	4.6	37.7	5.37	7.6
7. Kinetin 20 ppm at heading	42.8	6.24	22.8	42.7	5.53	30.4	43.9	5.94	22.7	41.9	6.43	28.9
8. Tender Coconut Water 2% (v/v) at PI and heading.	39.9	5.59	10.0	40.8	4.87	14.9	39.3	5.52	14.1	39.7	5.88	17.2
CD (0.05)	1.39	0.37	-	1.3	0.37	-	1.3	0.25	-	1.3	0.34	-

treatments as a substitute for kinetin since it contains growth promoting factors similar to kinetin. Observations on yield components were made based on standard procedures. Total leaf chlorophyll content of the first three leaves from the top, 21 days after flowering was estimated following the procedure suggested by Yoshida *et al.*, (1971). Yield data were recorded from each plot at the time of harvest. Data were statistically analysed.

RESULTS AND DISCUSSION

The data presented in Table 1 show that the growth regulators kinetin, GA3 and tender coconut water delayed leaf senescence by retarding chlorophyll disintegration in the variety CR 1009. Significant increase in the number of panicles per square meter, filled grains percentage, total dry matter and grain yield were recorded in plots treated with kinetin, GA3 and coconut water. The increases in grain yield were 23.4% (7.07 t/ha), 14.3% (6.55 t/ha) and 12.9% (6.47 t/ha) over control (5.73 t/ha) for kinetin 20 ppm, GA3 25 ppm and tender coconut water 2% (v/v) foliar sprays. A similar trend was noticed in the experiment conducted during thaladi season within the varieties Co 43, Ponni, white Ponni and ADT 38. Irrespective of the varieties, these three treatments significantly increased the total leaf chlorophyll content, number of panicle per square meter, filled grains percentage, total dry matter and grain yield over rest of the treatments (Table 2 and 3). Increase in grain yield over control was 22.8% (6.24 t/ha), 14.6% (5.82 t/ha), 10.0% (5.59 t/ha) in Co 43, 30.4% (5.53 t/ha), 17.3% (5.06 t/ha) and 14.9% (4.87 t/ha) in Ponni; 22.4% (5.94 t/ha), 17.4% (5.68 t/ha) and 14.1% (5.52 t/ha) in White Ponni and 28.9% (6.43 t/ha), 8.6% (5.42 t/ha) and 17.2% (5.88 t/ha) in ADT 38 for kinetin 20 ppm, GA3 25 ppm and tender coconut water 2% (v/v) foliar sprays.

In these studies exogenous application of kinetin, GA3 and coconut water significantly increased the yield contributing parameters - number of panicles per square meter, percentage filled spikelets, total dry matter and grain yield by increasing the leaf area, duration after flowering through delayed leaf senescence. This presumbly should have increased the photosyntetic efficienty and dry matter accumulation for a longer time than the control plants resulting in higher yield. Spikelet filling and grain yield in rice can be improved by increasing leaf longevity by kinetin as has been reported by Ray and Choudhri (1981) and Singh *et al.* *(1984).*

Besides, Cytokinins possess the property of directed transport of metabolites from source to sink (Mothes and Engelbrecht, 1961) and increase the number and size of the individual sinks (Holmes, 1974). The present investigation supports these observations. An increase in grain weight of wheat when isolated earheads were incubated in kinetin 20 ppm solution was reported by Vijayakumar (1978). Synthetic cytokinins induced increased grain yield in barley due to greater grain yields of the smaller shoots of each plant (Williams and Cartwright, 1980).

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USE OF PHOSPHATE SORPTION ISOTHERMS FOR ASSESSING P NEEDS OF MAIZE (*Zea mays*) IN SOME SOIL TYPES OF KARNATAKA

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ABSTRACT

Study of phosphorus sorption isotherms of vertisol (Hanchinal), alfisol (Gubbi), oxisol (Ankola) and inceptisol (Kudalasangum) to predict the P needs of Deccan - 101 maize (***Zea mays*** L,) revealed that an equilibrium P solution concentration of 0.2 ppm would be optimum to get maximum dry matter yield. Per cent phosphorus content of maize was also maximum in all the soil types at an equilibrium P concentration of 0.2 ppm. Near maximum uptake of P by maize in all soil types except oxisol was observed at an equilibrium concentration of 0.2 ppm.

KEY WORDS : Maize, P uptake, Phosphate sorption isotherms.

The phosphate concentration in the soil solution is vital to plant growth (Fox and Kemprath, 1970). If the phosphate concentration in the soil solution is the critical parameter for plant uptake of P, then one needs to take the phosphorus buffering into account in the determination of P fertilizer rate. The phosphorus solution concentration determines the diffusion gradient. The role of the labile fraction is primarily the renewal of P removed from the soil solution by plant roots. Beckwith (1964) suggested that the phosphate sorption, a technique which takes into consideration of P buffering capacity of soil (or capacity factor) and the P in soil solution (or intensity factor) to predict phosphate needs of soils. Ozanne and Shaw (1968) were successful in applying the P sorption isotherm concept in determining fertilizer rates for maximum plant growth. Work on the usability of assessing P needs on the basis of P sorption isotherm for the soil types of Karnataka is lacking. In this paper, Langmuir's adsorption isotherm was adopted to predict the critical P soil solution concentration required to get maximum yield of maize in vertisol, alfisol, oxisol and inceptisols of Karnataka.

MATERIALS AND METHODS

The bulk surface (0-15 cm) soil samples of vertisol, alfisol, exisol and inceptisol collected from Hanchinal, Gubbi, Ankola and Kudalsangam villages respectively were dried in shade and ground to pass

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