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Effect of gibbrellic acid on the yield of oil palm

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ABSTRACT

Oil palm *Elaeis guineensis* Jacq is the highest oil-yielding perennial plant. In this paper, the effect of Gibberellic acid on the weight of fruit bunches of Oil palm was assessed. The results showed a varying trend in the weights of Oil palm bunches present under all the treatments before 15 days of the fruit harvest. There was no significant difference in the weights of Oil palm fruit bunches in the treatments that were given 30 days prior to the harvest. Thus, the comparative assessment shows at par action of the Gibberellic acid on increase in the weights of Oil palm fruit bunches with time of application. On temporal scale, all the treatments of Gibberellic acid showed a similar action and were found to be effective in enhancing the weights of Oil palm fruit bunches. The weight of the Oil palm fruit bunches was more in the treatments with Gibberellic acid before 15 days. The treatments with 1ml/l and 2ml/l were almost the same. The comparison reveals the effectiveness of Gibberellic acid in increasing the weights of Oil palm fruit bunches.

Key words: Oil palm; Gibberellic acid; Fruit yield.

INTRODUCTION

Oil palm *Elaeis guineensis* Jacq is the highest oil-yielding perennial monoecious and bisexual plant. It is grown on a commercial scale throughout Malaysia, Indonesia and southern parts of India. The mesocarp is the source of palm oil and the seed yields palm kernel oil. The increase in kernel production has reduced the mesocarp-to-fruit and mesocarp oil-to-fruit ratios; although the mesocarp-to-bunch may not be lower because of the increased fruit set [1, 2, 3].

A plant hormone is an organic compound synthesized in one part of a plant and translocated to another part where, in very low concentrations, it causes physiological response and control[4]. Physiological control in plants is governed by four classes of plant hormones: inhibitors such as abscisic acid that block germination; auxins that control root formation and growth; the gibberellins that regulate protein synthesis and stem elongation; and cytokinins that control organ differentiation[5]. Gibberellic acid (GA3) (actually a group of related substances called gibberellins) was discovered as a metabolic byproduct of the fungus *Gibberella fujikuroi*, which causes the stems of growing rice to elongate so rapidly the plant collapsed. GA3 acid is a very potent hormone whose natural occurrence in plants controls their development. Although it has many effects regulating various physiological processes, including seed germination, the mobilization of endosperm storage reserves, shoot growth, flowering, floral development and fruit set, in recent years another important effect of GA3 was found: it induced pollen sterility in some plants such as sunflower, rice and onion[6, 7, 8, 9, 10].

Gibberellic acid is a very potent hormone whose natural occurrence in plants controls their development. Since Gibberellic acid regulates growth and elongation of cells, applications of very low concentrations can have a profound effect. Time of application is critical and too much Gibberellic acid application may have an opposite effect from that desired; too little may require the plant to be

repeatedly treated to sustain desired levels of Gibberellic acid[5]. This paper describes the effect of Gibberellic acid on the weight of fruit bunches of Oil palm.

MATERIAL AND METHODS

Study area and pesticide application

The Oil palms in the field stations of Directorate of Oil Palm Research (ICAR), Pedavegi, West Godavari District and Simhapuri Agro-products Limited, Nellore of Andhra Pradesh were selected for this study to analyze the effects of Gibberellic acid on the yield of Oil palm. The palms were treated with different concentrations of Gibberellic acid (Trade name-Cytozyme, Spic-make). Gibberellic acid is shown to increase the production of male inflorescences, and reduce production of females, in the Oil palm, *Elaeis guineensis* Jacq.[11] The treatments of this Gbberellic acid were administered as 1ml/l, 1.5ml/l and 2ml/l concentrations in three replicates each on the fruit bunches of Oil palm before 15 days and 30 days prior to harvesting.

Statistical analyses

The mean, Standard deviation, Standard error, etc. was determined. Besides, experimental plots, three replicates were also kept as control in a separate plot. The comparative assessment of yield was taken in terms of weights and was evaluated by one way analysis of variance (ANOVA). An alpha level of 0.05 was selected to claim any difference as a significant difference.

RESULTS AND DISCUSSION

The results of the treatment efficiency observed by the application of different concentrations of Gibberellic acid are presented in Table 1. The results show a varying trend in the weights of Oil palm bunches present under all the treatments before 15 days of the fruit harvest. There was no significant difference in the weights of Oil palm fruit bunches in the treatments that were given 30 days prior to the harvest. The weights of Oil palm fruit bunches recorded in the treatment at 15 days before showed a significantly (ANOVA, $P<0.01$). However, in the treatments given 30 days before, there was no significant (ANOVA, $P> 0.08$) difference amongst the mean values, indicating a comparable effect of Gibberellic acid in the increase in the weights with the variation in time. Thus, the comparative assessment shows at par action of the Gibberellic acid on increase in the weights of Oil palm fruit bunches with time of application.

Temporal variation in the insecticidal Effect

On temporal scale, all the treatments of Gibberellic acid showed a similar action and were

Fig. 1: Oil palm fruit bunches

found to be effective in enhancing the weights of Oil palm fruit bunches. The weight of the Oil palm fruit bunches was more in the treatments with Gibberellic acid before 15 days. The treatments with 1ml/l and 2ml/l were almost the same. The comparison reveals that the effectiveness of Gibberellic acid in increasing the weights of Oil palm fruit bunches (Fig.1). However, in case of the results of treatment by Gibberellic acid, the data shows a consistency as well as reliable estimate. Table 2 shows the temporal variation in Oil palm fruit bunch weights receiving treatment with different concentrations of Cytozyme.

It was known that gibberellins promote the germination of seeds in many species. In seeds, the principal gibberellin effect is to enhance cell elongation so the radicle can push through the endosperm, the seed coat that restricts its growth. However, ABA is a potent inhibitor of seed germination mainly because it slows radicle elongation and delays germination without preventing it[4, 5, 12]. It was found in this study that exogenous GA3 treatments of safflower plants inhibited endogenous gibberellic acid synthesis while they promoted endogenous ABA synthesis of seeds. The levels of endogenous GA3 were

Table 1: Comparative assessment of Oil Palm fruit bunch weights before and after treatment with different concentrations of Cytozyme (N= 6)

Time period	Cytozyme (Conc.)	Mean ± SD (weight)	SE	95% CI for Mean		Min.	Max.	P
				LB	UB			
After 15 days	1.0 ml/l	24± 2	1	22	26	22	27	< 0.01
	1.5ml/l	19± 4	2	15	23	15	26	
	2.0 ml/l	24± 2	1	21	26	21	26	
	Control	20± 4	1	18	22	14	25	
After 30 days	1.0 ml/l	20± 3	1	17	23	16	24	< 0.08
	1.5ml/l	15± 3	1	12	19	12	21	
	2.0 ml/l	19± 4	1	15	23	15	25	
	Control	17± 3	1	15	19	12	24	

Bold values of P indicate significant difference between the means

Table 2: Temporal variation in Oil Palm fruit bunch weights receiving treatment with different concentrations of Cytozyme (N= 6)

Time period	Cytozyme (Conc.)	Mean ± SD (weight)		SE	95% CI for Mean		Min.	Max.	P
					LB	UB			
AControl	After 15 D	20	4	1	18	22	14	25	< 0.02
	After 30 D	17	3	1	15	19	12	24	
1ml/l	After 15 D	24	2	1	22	26	22	27	< 0.01
	After 30 D	20	3	1	17	23	16	24	
1.5ml/l	After 15 D	19	4	2	15	23	15	26	< 0.08
	After 30 D	15	3	1	12	19	12	21	
2ml/l	After 15 D	24	2	1	21	26	21	26	< 0.02
	After 30 D	19	4	1	15	23	15	25	

Note: SD: Standard deviation; SE: Standard Error; CI: Confidence Interval; LB: Lower Bound; UB: Upper Bound; P: Probability

gradually decreased in contrast to endogenous ABA levels increasing exogenous GA3 concentrations, especially up to 300 ppm. The lowering endogenous GA3/ABA ratio in the seeds decreased the rate of seed germination in particular. Similar results were also reported in onion and rice[7, 8]. Since gibberellins and ABA act antagonistically in many aspects of seed development, it may be suggested that maturation phase gene expression is regulated by GA/ABA ratio in seeds.

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