CHEMICAL DWARFING OF 'KPAKPO SHITO' *(CAPSICUM SINENSE* JACQ.) PLANTS GROWN UNDER GLASSHOUSE CONDITIONS: RESPONSE OF 'KPAKPO SHITO' PLANTS TO DIFFERENT CONCENTRATIONS AND DOSES OF PACLOBUTRAZOL

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ABSTRACT

The dwarfing effect of concentration and dosage of applied paclobutrazol through soil drenching on 'Kpakpo Shito' (Capsicum sinense Jacq.) plants grown in plastic pots at Wye College, University of London, U.K. in winter (October to March) under glasshouse conditions was investigated. The dosage of chemical applied to reduce vegetative growth was not as critical as concentration. All doses of 10ppm and 10ml of the higher concentrations (20 and 50ppm) were ineffective in reducing vegetative growth. Applying 20 to 40ml of 50ppm paclobutrazol greatly reduced vegetative growth while the same range of dosage of the 20ppm concentration reduced vegetative growth to an optimum. Reproductive growth was not significantly influenced by the treatments. It became evident that paclobutrazol is potent in modifying the form of 'Kpakpo Shito' plants without adversely affecting reproductive growth.

Keywords: *Growth Retardants, Paclobutrazol, Concentration, Dosage, 'Kpakpo Shito', Non-Traditional Export Crop.*

INTRODUCTION

Fruits of 'Kpakpo Shito' *(Capsicum sinense* Jacq.) plants have unique flavour and characteristic aroma which make the crop a potential non-traditional export crop. The export potential of the crop has already been stressed upon [1]. In an attempt to grow 'Kpakpo Shito' (KS) in Britain under glasshouse conditions during winter, the plant etiolated and lodged which hampered harvesting [2]. It therefore necessitated improving the plant form. While breeding of new genotypes and the manipulation of the environment are other possible ways of achieving desirable forms of crop plants [3, 4], plant growth regulators provide a more immediate and economic way to bring about the desirable changes in plant habit [5]. As a result, plant growth regulators especially, growth retardants, have been used on various crops to reduce vegetative growth thus producing shorter and compact plants [6, 7].

Paclobutrazol ((2RS, 3RS) -1 - (4 - chlorophenyl) - 4, 4 - dimethyl -2 -(1H - 1,2,4 - triazol - 1 - yl) pentan - 3-ol), a broad spectrum chemical growth retardant which was commercially introduced in 1985 as 'Bonzi' for use on ornamental crops and as 'Cultar' for top fruit [5] has also been used experimentally on vegetable crops like sweet pepper [8], tomato [9], sugar beet [10] and carrot [11].

A series of experiments were conducted at Wye College, University of London, U.K., using paclobutrazol in various dimensions with the objective of producing shorter and compact plants. This desired plant form will facilitate closer spacing and easier harvesting and for a considerably increased yield per unit area. The present work reports on the responsiveness of KS plants to different concentrations and doses of paclobutrazol.

MATERIALS AND METHODS

Seeds extracted from fruits of KS plants were pre-germinated in Petri dishes in incubators at 30°C for 7 days. Germinated seeds were pricked out singly into cells of 2.5 cm modular trays filled with Irish Peat Moss potting compost. The seeds were then put in a glasshouse cubicle with minimum day/night temperature settings at 30°/20°C and ventilation set at 35°C. Forty eight day-old seedlings were transplanted singly into 13cm plastic pots of compost (4 parts Irish Peat Moss to 1 part grit). A Bio-P-base nutrient mixture, a fertilizer containing NPK 7-5-6, trace

elements and lime neutralizer was added to the compost to raise the pH of the peat.

Seven days after transplanting, seedlings with an average of six leaves were soil drenched with combined doses of 10, 20, 30 and 40ml and paclobutrazol concentrations of 10, 20 and 50ppm. These gave twelve treatment combinations and a control which was watered normally. Each treatment was replicated three times in a randomized complete block design.

The paclobutrazol drenched pots were initially stood in saucers to prevent possible drainage of the chemical and to avoid contamination of other treatments through the capillary mats used on the benches. Two days before applying the paclobutrazol, the plants were watered. No watering was done 2-4 days after drenching after which normal watering resumed and the frequency depended on the stage of plant growth. The seedlings were given Libfeed 214 (NPK 16-8-32 plus trace elements) 6 weeks after transplanting and thereafter, continued at weekly intervals.

Whiteflies and spider mites were controlled using the parasite *Encarsia formosa* and the predator *Phytoseiulus persimilis* respectively which were introduced onto the plants monthly. Although pepper is to a greater extent self pollinated [12] it was necessary to use an electric vibrator (commercially known as electric bee) at frequent intervals to assist pollination [13] and subsequent fertilization and fruit set.

Plant height, canopy spread, stem diameter, leaf area, shoot/root ratio, fresh and dry weights of shoot and total plant and reproductive growth measured, are discussed in the results. Analysis of variance was performed on all recorded data and the Least Significant Difference (LSD) test was used to determine differences between treatment means.

RESULTS

Vegetative growth

Vegetative growth data collected in the experiment are summarized in Tables 1 and 2. All doses of 10ppm were ineffective in reducing plant height, canopy spread, stem diameter, leaf area (Table 1) and shoot/root ratio (Table 2). Similarly, 10ml of the higher concentrations (20 and 50ppm) was also ineffective in all the vegetative growth parameters except in leaf area where plants drenched with 10ml of 50ppm significantly ($P < 0.05$) reduced leaf area than the control plants.

Table 1: Effect of different concentrations and doses of paclobutrazol on plant height, canopy spread stem diameter and leaf area.

Concentration (ppm)	Dosage (ml)	Plant height (cm)	Canopy spread (cm)	Stem diameter (cm)	Leaf area (cm)
0	0	55	53	0.90	4100
10	10	44	54	0.73	3250
	20	48	56	0.78	3000
	30	57	48	0.80	3300
	40	44	43	0.64	3400
20	10	67	58	0.82	3450
	20	39	44	0.73	2700
	30	34	35	0.68	2800
	40	38	37	0.62	1900
50	10	46	42	0.72	2300
	20	14	21	0.49	640
	30	25	27	0.52	950
	40	18	23	0.50	650
LSD 0.05		23	14	0.13	700

Applications of 20ml and above of the higher concentrations reduced all the vegetative growth parameters and the extent of reduction was more consistent with increasing concentration which reflected in a proportional decrease in shoot and total plant dry weights (Table 2). Shoot and total plant fresh weights of the treatments followed a pattern similar to their effects on dry weights.

Table 2: Effect of different concentrations and doses of paclobutrazol on shoot/root ratio and shoot and total plant dry weights.

Concentration (ppm)	Dosage (ml)	Shoot/root ratio	Shoot dry weight (g)	Total plant dry weight (g)
0	0	10.4	44	49
10	10	9.0	31	34
	20	9.2	31	33
	30	9.3	36	40
	40	8.1	33	37
20	10	8.8	43	48
	20	8.7	24	27
	30	7.8	24	28
	40	7.0	19	22
50	10	8.1	34	36
	20	6.2	4	5
	30	6.4	7	8
	40	5.6	5	6
LSD 0.05		1.7	11	13

Reproductive growth

The treatments did not significantly ($P > 0.05$) influence reproductive growth hence days to flower bud appearance, flower opening and fruit set averaged 88, 108 and 115 days respectfully after germination. The average percentage of plants setting fruits in the treatments was 91.6.

DISCUSSION

Results obtained from the doses especially within the range 20 to 40 ml were similar ($P > 0.05$) under each concentration. The results seem to suggest that growth inhibition is not greatly dependent on dosage corroborating the results of Shearing and Batch [14]. They similarly found in amenity grass that the effect of paclobutrazol was virtually independent of volume of application and that volumes of 100 to 2000 l/ha were equally effective. This infers that once there is a minimum uptake and translocation of a particular concentration of the chemical to meristematic areas, the sites of action, growth inhibition is inversely proportional to the concentration applied. As a result, the highest concentration of 50ppm reduced vegetative growth in terms of reduced plant height, canopy spread, leaf area and dry weights of shoot and total plant by more than 50% of the control plants.

The treatments did not significantly ($P > 0.05$) influence reproductive growth which delayed under winter conditions when solar radiation levels which affect reproductive growth are generally low. Sachs [15] has indicated that higher radiant energy is required for reproductive than continued vegetative development and the reversion to vegetative state is often observed in flowering plants placed at low irradiance levels. A mean of 4.4 MJ m^{-2} day^{-1} recorded for the period of the experiment might have been too low for the chemical to either enhance or otherwise, the reproductive growth of KS plants. Perhaps all the treatments had positive benefit from the use of the electric vibrator which might have assisted pollination and fertilization, hence the non-significance in reproductive growth by the various treatments.

CONCLUSION

The results have shown that paclobutrazol is a potent chemical capable of reducing vegetative growth thus modifying the form of KS plants without adversely affecting reproductive growth. Its effectiveness was concentration dependent rather than volume of the chemical applied. Further investigations are however recommended to study the potentialities of paclobutrazol.

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