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Efficacy of Plant Growth Regulators to Manage the Insect Pests of Cotton

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Abstract: The changes incurred in the plant growth by the application of growth regulators may conversantly affect the insect plant interaction. Therefore, experiments were conducted to evaluate the effect of different plant growth regulators; Atonic, Cytokin, Cytoplex and Pix for the management of sucking complex and bollworms in cotton crop. Maximum seed cotton yield and minimum infestation of pink and spotted bollworms were recorded in Pix and Cytokin treated cotton. Both of the regulators enhanced the boll size and boll retention power of the plant and maximum number of bolls and larger boll size were recorded from the plots treated with Pix or Cytokin. Bioregulators, Pix and Cytokin were also more effective to check the infestation of jassids, thrips and white flies as compared to Atonic and Cytoplex treatments. Atonic and Cytoplex did not prove effective against cotton bollworms and for the enhancement of seed cotton yield.

Key words: Cotton pests, management, plant growth regulators

Introduction

Cotton is the principal cash crop of Pakistan and provide domestic edible oil as well as raw material to textile mills and the garment industry. The yield of cotton is very low in Pakistan and the potential production of the crop is reduced by 20.7% due to the ravages of insect pests particularly bollworms and sucking complex (Ali, 1983). Control of insect pests in cotton largely depends on application of insecticides which has induced resistance and as a result to achieve effective control, often more quantity of chemicals have to be applied (Natwick, 1987). Moreover, numerous application of insecticides for the management of pests produce serious outbreaks of secondary pests in cotton (Carruth and Moore, 1973). It is therefore, imperative to complement the conventional insecticidal management techniques with safe and economical tactics to eliminate or reduce the use of insecticides. Among the alternatives, host plant resistance either genetically controlled or induced seems to have great potential and could be exploited alone or in combination with insecticide for the management of bollworms and sucking complex in cotton.

Plant growth regulators are being used throughout the world to control undesirable vegetative growth. The application of Pix has proved in controlling the excessive vegetative growth and enhancing the fruiting bodies of cotton which subsequently increased the yield (Briggs, 1980, 1981 and 1982; Reddy *et al*., 1990 and 1992). However, Walter *et al.* (1980) reported that the consistent control of plant height and increase in seed cotton yield by Pix is inconsistent and environmental dependent. Kerby (1985) and Stuart *et al,* (1989) reported the improved water relation and Hodges *et al.* (1991) reported the increased photosynthetic rate in Pix treated cotton. The changes incurred due to growth regulators in plant may affect the insect plant interactions. The effect of plant growth regulators on cotton bollworm, *Helitohis zea* (Zummo *et al.*,1984), green bug (Dreyer *et al.*,1984) and azalea lace bug (Coffelt and Schultz, 1988) have been reported. The present studies were conducted to evaluate the effect of different plant growth regulators, Atonic, Cytokin, Cytoplex and Pix for the management of sucking and bollworm complexes of cotton crop.

Materials and Methods

The influence of plant growth regulators to develop pseudo resistance in cotton plants against sucking complex; jassids, thrips, white flies and mites and bollworms; spotted, spiny and pink, were studied at the experimental farm of Nuclear Institute of Agriculture, Tandojam during 1997-98 and 1998-99 cotton growing seasons. Cotton variety Reshmee was sown in plots (10x6 metres) with randomized complete block design in four replicates. Each replicate comprised of six sub plot for respective treatments (Table 1). Four different bioregulators, Atonic, Cytokin, Cytoplex and Pix were sprayed at the start of square formation, first flower appearing and two weeks after first flower appearing stages of the cotton crop. The effect of insecticides treatments [2 sprays with Monocrotophos 40 SCW and 2 sprays with Polytrin-C (Cypermethrin + Profenofos) 440 EC] and untreated control was compared with bioregulator treatments. The bioregulators and insecticides were sprayed with knap sack sprayer having mist nozzle at the rate and time mentioned in Table 1. The infestation of sucking pests was recorded at weekly interval from

Table 1: Details of experiment

	Stage of growth of cotton plant			
Treatments	Pin square	1st. flower	Two weeks after 1st flower	Boll formation
Control	Water	Water	Water	Water
Atonic	300 ml ha^{-1}	600 ml ha^{-1}	600 ml ha^{-1}	--
Cytokin	280 ml ha^{-1}	560 ml ha^{-1}	560 ml ha^{-1}	--
Cytoplex	300 ml ha^{-1}	600 ml ha^{-1}	600 ml ha^{-1}	--
Pix	--	1000 ml ha^{-1}	--	1000 ml ha^{-1}
Insecticide	Nuvacron	Nuvacron	Polytrin-C	Polytrin-C
alone	1000 ml ha^{-1}	1000 ml ha^{-1}	1250 ml ha^{-1}	1250 ml ha^{-1}

randomly selected 10 plants per replicate. The infestation of cotton bollworms was recorded at weekly interval from randomly picked 100 green bolls. The bolls were picked randomly and brought to the laboratory for dissection and confirmation of the specific bollworms infestation.

Results and Discussion

The effect of different growth regulator treatments on the population of jassids, thrips and white flies, varied significantly between the treatments (Table 2). Results indicated that Pix treatment significantly reduced the jassid population as compared to Cytoplex. Whereas per leaf population of jassids was statistically at par in Pix and Cytokin treatments. However, per leaf population of jassids was comparatively higher in Atonic, insecticides treatments and control. The application of Cytoplex and Atonic treatments did not control the jassids infestation effectively. The mean per leaf population of thrips was significantly low in Pix and Cytokin treatments. There was no significant difference in the population of thrips recorded in Atonic, Cytoplex and insecticides treatments. However, the population of thrips was significantly higher in untreated control plots. Results revealed that Pix and Cytokin have significantly managed the population of thrips as compared to other treatments. White flies population was significantly low in Pix, Cytokin and insecticides treated plots followed by Cytoplex. Whereas higher population of white flies was recorded in Atonic treatment. The mean population of jassids and white flies remained low during both the cotton growing season, whereas, the population of thrips was higher as compared to the other pests.

All the tested plant growth regulators controlled the infestation of spotted bollworm (Table 3) but the infestation of pink bollworm was significantly low in Pix and Cytokin. The infestation of spotted bollworm in insecticides treated plots was at par with bioregulators, Pix and Cytokin treated plots. The infestation of pink bollworm was significantly less in plots treated with pix and cytokin. Results revealed that Pix and Cytokin proved effective for the control of cotton bollworms and sucking pests. However, the boll rot disease was significantly less in Pix treatment as compared to Cytokin and Atonic. Growth regulator, Atonic did not prove effective in controlling the infestation of boll rot disease as compared to the other treatments. Maximum boll rot disease was recorded in the control.

Results indicated (Table 4) that Pix treatment reduced the plant height, whereas, other treatments had no plant height reducing effect. The Cytokin treatment increased the cotton plant height significantly as compared to Pix. The treatment of Pix also reduced the number of fruiting branches per plant. Whereas, Cytoplex treatment significant increased the number of fruiting branches per plant. Higher number of bolls per plant and maximum boll diameter was recorded from Pix, Cytokin and insecticides treated plots. Single boll seed cotton weight was also significantly higher in Pix treatment as compared to the other treatments.

Over all population of the sucking pest complex was remained low during both the cotton-growing season. Part of the reason may have been fortuitous weather conditions. As the population of jassids, thrips and white flies increased, the effect of different growth regulators became significant. However, none of the growth regulator application increased the infestation of sucking complex and bollworms. Among the growth regulators used, Pix proved more suitable than others to produce resistance against cotton bollworms and sucking complex. Zummo *et al.* (1984) observed mortality of insect pests, in Pix treated cotton plants due to the induced host plant resistance. However, increased resistance to the tobacco budworm, *H. virescens* was not found in artificially (Graham *et al.*, 1987) or naturally (Pfrimmer, 1984) infested cotton plants treated with Pix. Our results of plant height and boll diameter confirm the usual morphological effect of Pix. The population levels of jassids, thrips, white flies and bollworms were comparatively low in bioregulator treated cotton than untreated control plots. Ashfaq *et al.* (2001) also observed similar trend in the reduction of sucking pest and bollworm infestation and reduction in the height of cotton plants treated with different doses of Pix. The actual mechanisms involved in causing reduction in insect pest infestation are still unknown. The reductions in insect pest infestation in cotton may be attributed to the enhanced production of secondary

Table 2: Effects of plant growth regulators on the population of sucking pests

Treatments	Mean per leaf population		
	Jassids	Thrips	White flies
Atonic	0.85b	4.53ab	2.16a
Cytokin	0.58bc	2.17c	0.89c
Cytoplex	0.84ab	4.72ab	1.81ab
Pix	0.37c	1.47c	0.58c
Insecticides alone	0.68ab	4.07b	1.25bc
Control	2.78a	7.37a	3.11a

Means followed by similar letters are non-significant (P≥0.05).

Table 3: Effect of growth regulators on the infestation of bollworms, boll rot disease and seed cotton yield

Treatments	Infestation (%)			
	Pink bollworm	Spotted bollworm	Boll rot disease (%)	Yield/plot (kg)
Atonic	7.05a	7.128ab	9.35ab	3.69c
Cytokin	4.01b	4.490c	7.29bc	6.81ab
Cytoplex	6.94a	5.510bc	6.20cd	3.71c
Pix	3.12b	3.403c	4.29d	7.75a
Insecticides	5.05ab	4.967bc	5.37cd	6.15b
Control	7.53a	9.998a	11.01a	3.25c

Means followed by similar letters are non-significant (P≥0.05).

Table 4: Effect of different growth regulators on agronomical characters of cotton

Treatments	Plant height (cm)	Fruiting branches/plant	No. of boll/plant	Boll diameter (cm)	Single boll seed cotton weight (gm)
Atonic	116.40ab	27.70c	33.05bc	2.90d	2.83b
Cytokin	124.97a	28.85bc	41.00a	2.95bc	2.90b
Cytoplex	109.7b	32.20a	33.15bc	2.91bc	2.83b
Pix	72.60ab	19.40d	45.75a	3.13a	3.20a
Insecticide alone	112.55ab	31.00ab	37.00ab	2.98b	2.97b
Control	113.40ab	27.95c	28.55c	2.84d	2.83b

Means followed by similar letters are non-significant.

biochemicals like gossypol, tannis etc. or due to early maturity of the plants which helped in limiting bollworms damage. The open canopies of cotton plants treated with bioregulators may also help biological as well as physiological forces exert pressure on population of sucking complex and bollworms infestation.

The induction of resistance in cotton plants treated with growth regulators is not evident in literature. Campbell *et al.* (1984) reported significant reduction in the population of green bug, *Schizaphis graminum* (Rond.) and its reproduction in sorghum crop. They also observed that induced resistance against *H. zea* in tomato plants treated with growth regulators was higher than control. We observed that growth regulators have significant effect for inducing resistance in cotton crop. Bioregulators used did not enhance any insect pests attack in the present studies. However, Mulrooney *et al.* (1985) observed the increased infestation of bollworms in cotton crop treated with growth regulators.

Studies indicated that bioregulators especially Pix, significantly induced the resistance in cotton against bollworms and sucking complex as compared to untreated control. The effect of growth regulators may be more significant when they will applied in conjunction with insecticides. Moreover, the treatment of growth regulator especially Pix, with insecticides may save the application of insecticides which consequently reduced the environmental pollution and protected the beneficial insect fauna. It is therefore, inferred that for effective control of insect pests of cotton, the growth regulators may be considered as a component of integrated pest management.

References

Ali, S., 1983. Guidance for farmers. Pak. Agric., 4: 5-6.

Ashfaq, M., M.Y. Munir and A. Ali, 2001. Effect of Pix, a plant growth regulator, on the development of major insect pests, growth and yield of cotton variety NIAB-86. Balochistan J. Agric. Sci., 2: 35-37.

Briggs, R.E., 1980. Effect of the plant regulator Pix on cotton in Arizona. Proceedings of Beltwide Cotton Prod. Res. Conf., pp: 32-34.

Briggs, R.E., 1981. Varietal response to Pix treated cotton in Arizona. Proceedings of Beltwide Cotton Prod. Res. Conf., pp: 47.

Briggs, R.E., 1982. Response of plant population to cotton treated with Pix in Arizona. Proceedings of Beltwide Cotton Prod. Res. Conf., pp: 54.

Campbell, B.C., B. G. Chan, L. L. Creasy, D. L. Dreyer, L. B. Robin and A.C. Wais, 1984. Bioregulation of host plant resistance to insects (Ory, R. L. and Rittig, F. R. (Eds.). In: Bioregulators:Chemistry and Action. Amer. Chem. Soc. Symposium Series No. 257, pp: 193-203.

Carruth, L.A. and L. Moore, 1973. Cotton scouting and pesticide use in eastern. Arizona. J. Econ. Entomol., 66: 187-190.

Coffelt, M.A. and P.B. Schultz, 1988. Influence of plant growth regulators on the development of the Azalea lace bug (Hemiptera:Tingidae). J. Econ. Entomol., 81: 290-292.

Dreyer, D.L., B.C. Campbell and K.C. Jones, 1984. Effect of bioregulator treated sorghum on green bug fecundity and feeding behaviour:Implications for host-plant resistance. Phytochem., 23: 1593-1596.

Graham, C.T., J.N. Jenkins, J.C. Mccarty and W.L. Parrot, 1987. Effects of Mepiquat chloride on natural plant resistance to tobacco budworm in cotton. Crop Sci., 27: 360-361.

Hodges, H.F., V.R. Reddy and K.R. Reddy, 1991. Mepiquat chloride and temperature effects on photosynthesis and respiration of fruiting cotton. Crop Sci., 31: 1302-1308.

Kerby, T.A., 1985. Cotton response to Mepiquat chloride. Agron. J., 77: 515-518.

Mulrooney, J.E., P.A., Hedin, W.L. Parroth and J.N. Jonkins, 1985. Effects of Pix, a plant growth regulator, on allelochemical content of cotton and growth of tobacco budworm larvae (Lepidoptera:Noctuiidae). J. Econ. Entomol., 78: 1100-1104.

Natwick, E.T. (Ed.), 1987. Cotton insect and production, Colorado River Cotton Growers Association, El-Centro, CA., pp: 3-4.

Pfrimmer, T.R., 1984. Interaction studies with yield enhancement, plant growth regulators and late season insecticides. In: Proc. Beltwide Cotton Production Research Conference, National Cotton Council Memphis, Tenn., pp: 192-195.

Reddy, V.R., D.N. Baker and H.F., Hodges, 1990. Temperature and Mepiquat chloride effects on cotton canopy architecture. Agron. J., 82: 190-195.

Reddy,V.R., A. Trint and B. Acock, 1992. Mepiquat chloride and irrigation versus cotton growth and development. Agron. J., 84: 930-933.

Stuart, B.L., V.R. Isbell, C.W. Wendit and J.R. Abernathy, 1989. Modification of cotton water relations and growth with Mepiquat chloride. Agron. J., 76: 651-655.

Walter, H.W., H.W. Guasman, F.R., Rittig L.N. Namken, D.E. Escobar and R.R. Podriguez, 1980. Effects of Mepiquat chloride on cotton plant, leaf and canopy structure and dry weights of its components. In: Proc. Beltwide Cotton Prod. Res. Conf. St. Louis Missouri, pp: 32-33.

Zummo, G.R., J.H. Benmedict and J.C., Segers, 1984. Effects of plant growth regulator, Mepiquate chloride on host plant resistance in cotton bollworms (Lepidoptera: Noctuiidae). J. Econ. Entomol., 77: 922-924.