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Annals of Biological Research, 2013, 4 (1):53-58
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Effect of pix regulator on vegetative growth of cotton plant

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ABSTRACT

In this research pix effect as plant growth regulators on growth parameters of cotton plant were evaluated. Cotton seeds (Gossypium hirsutum L. cv Ci-Ocra) were planted under pots condition in photoperiods 20 ± 2 ºC and 14– h light /10 –h dark. After 80 days, pix was sprayed in different concentrations include 0 (control), 0.5,1, 1.5, 2 L.ha^{-1} twice within ten days on shoot of cotton plants. Three weeks after spraying were separated root from shoot and growth parameters were determined. The results showed that pix different treatments decreased stem length, leaf number and leaf area in comparison with control .Also pix in higher concentration reduced shoot to root rate, nodes number. Our data showed pix application in concentration 2 L.ha^{-1} increased fresh and dry weight in leaf cotton. Parameters as root length, fresh and dry weight of stem and root did not change significantly at different concentrations of pix.

Key words: cotton, growth regulators, root , shoot

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is subtropical and one of the important cash crops in word [5, 14], perennial plant with an indeterminate growth habit. Vegetative and reproductive growth occurs simultaneously while vegetative growth is necessary to support reproductive growth. Under excessive vegetative growth fruit abortion may increase crop maturity may be delayed and harvested reduced. Excessive vegetative growth leads to severe production problems fruit abortion, delayed maturity, boll rot and harvest difficulties often coincide with excessive vegetative growth**.** Cotton plant has a natural mechanism to prevent excessive vegetative growth. In many cases growth regulators are needed to maintain proper plant size and to promote boll set and early maturity [11]. Manipulation of cotton plant architecture using plant growth regulators can be an agronomic strategy for obtaining high yields [7, 22]. Plant growth regulators are substances when added in small amounts modify the growth of plant usually regulation, they are considered as new generation of agro-chemicals after fertilizers, pesticides and herbicides [8]. The use of these compounds to reduce plant height in cotton results in earlier maturity and, under some circumstances, increased yield[10]. Plant growth regulators play a key role in internal control mechanism of plant growth by interacting with key metabolic processes such as nucleic acid and protein synthesis [11].

One of Plant growth regulators is Pix (N,N-dimethylpiperidiniumchloride), commonly referred to as Mepex, Topit, and Mepiquat Chloride and consists of 4.2 % N, N-dimethyl piperidinium chloride, a quaternary ammonia compound [16,18].

Pix which is commonly used as growth retardant, when applied as foliar spray reduce the vegetative growth of plant, leaves become coarser and dark green in color [3, 4, 23]. Pix inhibits gibberellin biosynthesis, which implies that

they cause growth reduction by decreasing cell elongation and reduce the elongation of the internodes below the meristem [9, 12, 13, 15]

Manipulation of cotton (*Gossypium hirsutum* L.) plant architecture using plant growth regulators can be an agronomic strategy for obtaining high yields [22] Obtaining cotton plants with an adequate height for growing with smaller between-row spacing and at higher population densities than usual is important for the success of the crop, particularly when it is planted during non-ideal periods [17].

The aim of this research was to study the effect of different values of pix on growth parameters of cotton (*Gossypium hirsutum* L. cv Ci-Ocra) in vegetative phase.

MATERIALS AND METHOD

Planting

Experiments were conducted in 2009 in Gorgan city of Iran. Cotton seeds(*Gossypium hirsutum* L. cv Ci-Ocra) were placed in pots including 5 Kg of soil (Si-Clay tissue) in photoperiods 20 ± 2 ºC and 14– h light /10 –h dark. After 80 days pix was sprayed in different concentrations include 0 (control), 0.5 , 1, 1.5 , 2 L.ha-1 twice within ten days on shoot of cotton plants. Three weeks after spraying were separated root from shoot and growth parameters were determined. Each treatment was replicated four times and arranged in a randomized complete block design.
Root and shoot length was measured with a ruler (cm) and weight of them was measured on scales with an accuracy of 0.001g.

The statistical significance of the difference between parameters was evaluated by means of Duncan-test on SPSS 11.5 and for each treatment and control, four replications were selected. The results were given in the text as p, the probability values, and $p \leq 0.05$ was adopted as criterion of significance.

RESULTS

Pix effect on stem and root length, rate them and nod number

The effect of different amounts of pix on stem and root length of cotton fig 1 was shown. The results indicated that pix different concentrations decreased stem length in comparison with control while had not significant effect on root length of cotton.

Also pix application in concentration 2 L.ha^{-1}decreased shoot to root rate in comparison with control and this rate had no significant different in other treatments (fig2)

As it was seen in fig 3 spraying of pix in concentrations 1.5 and 2 L.ha^{-1}cause decrease nodes number in cotton stem in comparison with control.

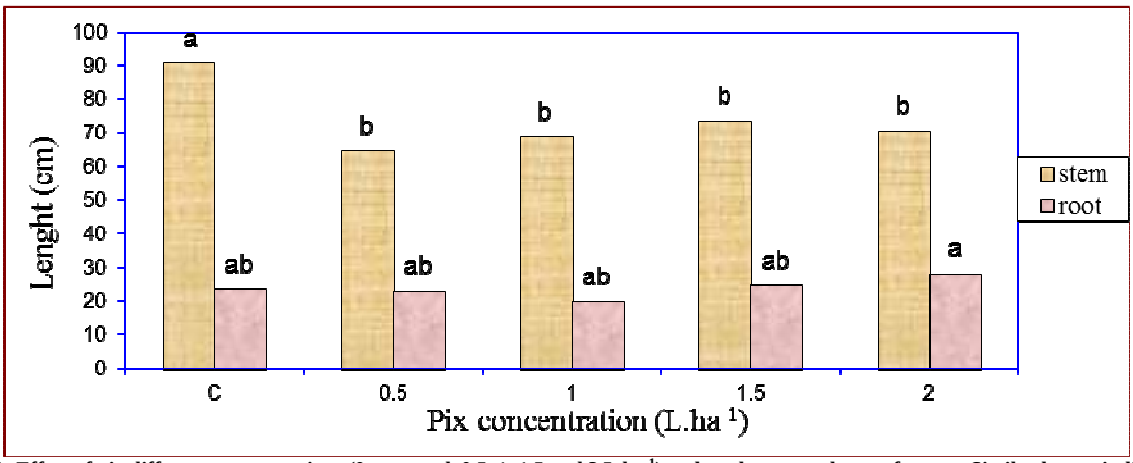

Fig 1: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on length stem and root of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

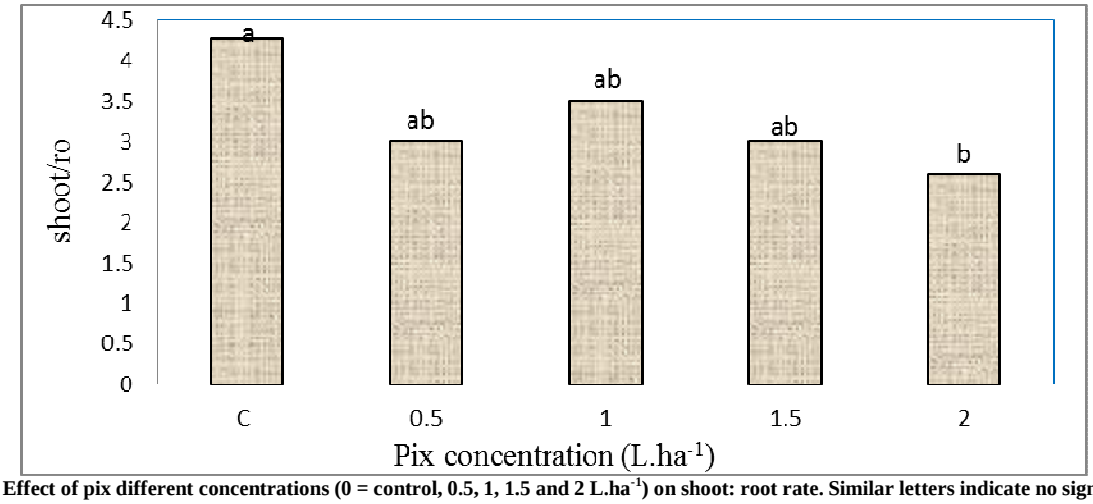

Fig2: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on shoot: root rate. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

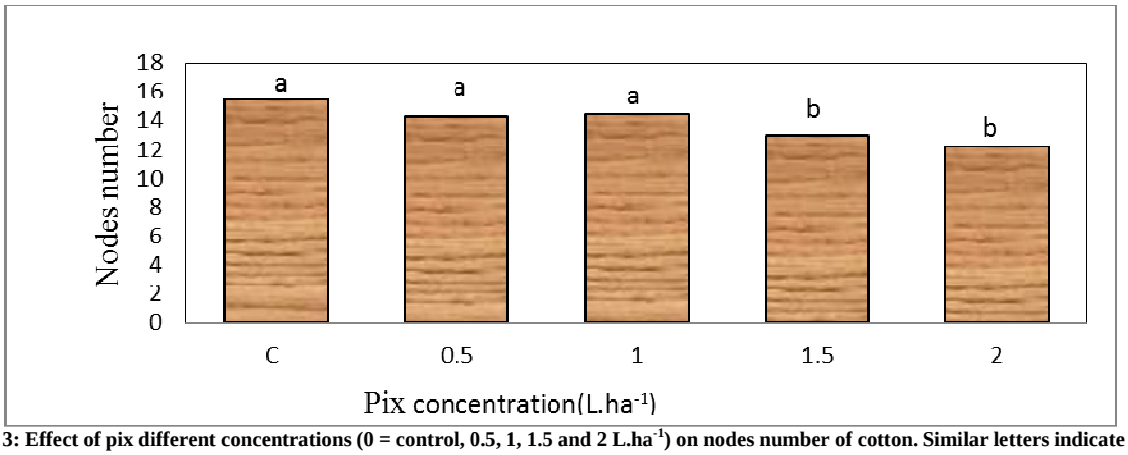

Fig 3: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on nodes number of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

Pix effect on fresh and dry weight of stem, leaf and root

According to the results of this research in stem only pix in concentration 1L.ha^{-1} decreased fresh weight in comparison with control. In leaf maximum fresh weight was seen in treatment of 2 L.ha^{-1} of pix and there were no significant differences between the other treatments and control. The results also indicated that pix different concentrations had not significant effect on fresh root of cotton (fig 4)

The results showed minimum dry weight of stem was in concentration 1L.ha^{-1}of pix. Also there were no significant differences in dry weight of cotton leaf and root between the various concentrations of pix and control (fig5)

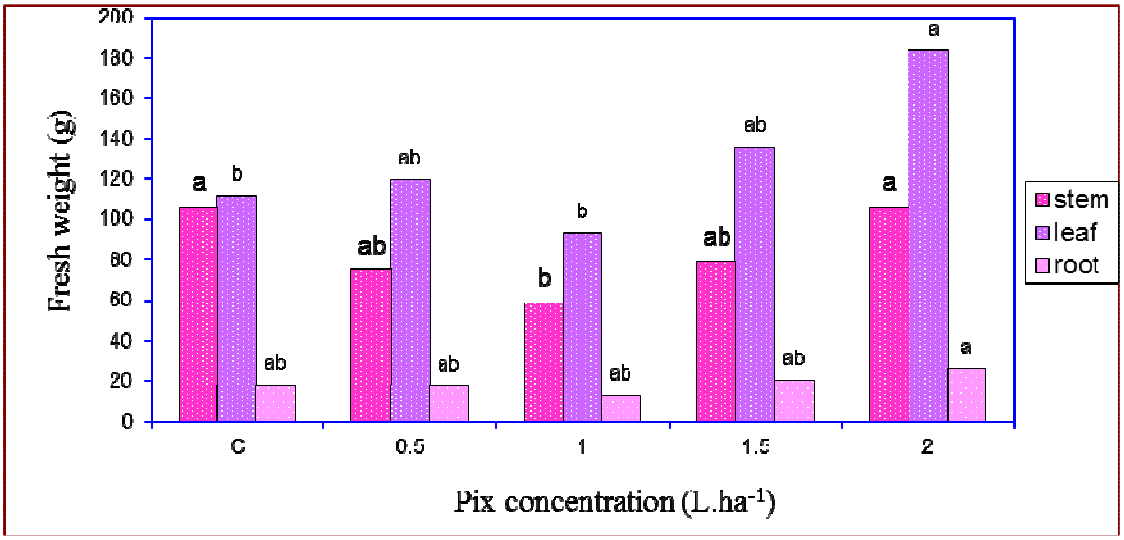

Fig 4: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha-1) on stem, leaf and root fresh weight of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

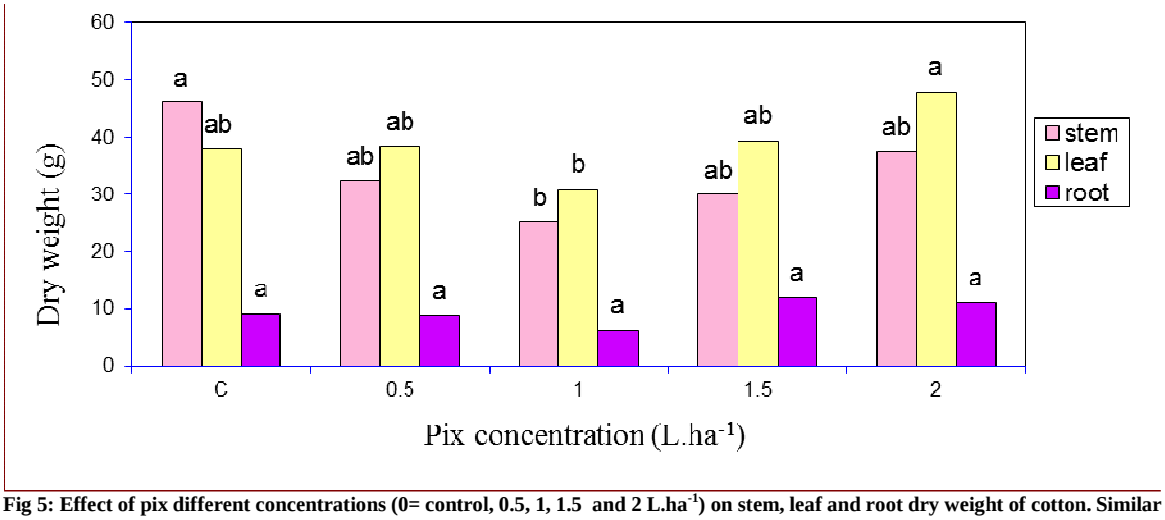

Fig 5: Effect of pix different concentrations (0= control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on stem, leaf and root dry weight of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

Pix effect leaf number and leaf area

According to the results of this research, application of pix in concentrations difference decreased leaf number in comparison with control (fig 6).

Also spraying of pix in various concentrations cause decrease leaf area i in comparison with control that this decreasing in concentration 1, 1.5 and 2 L.ha^{-1} Was considerable (fig 7)

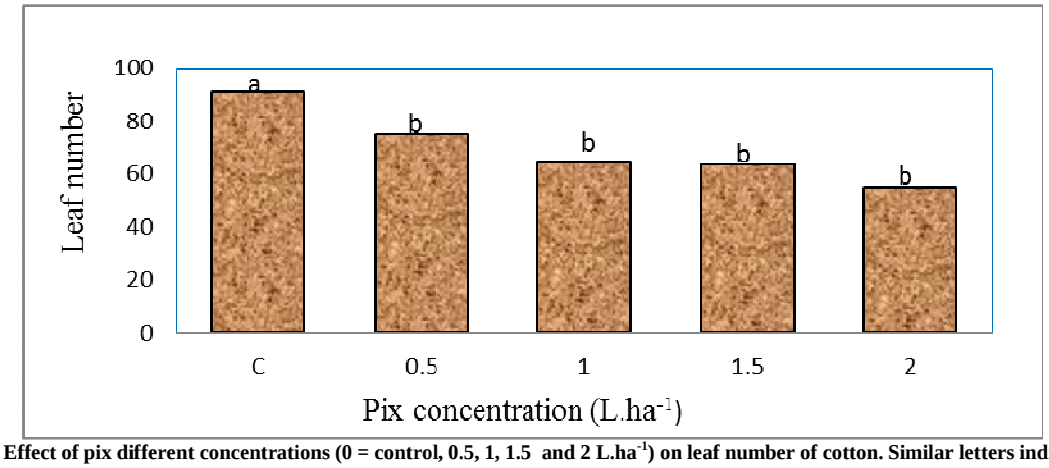

Fig 6: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on leaf number of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

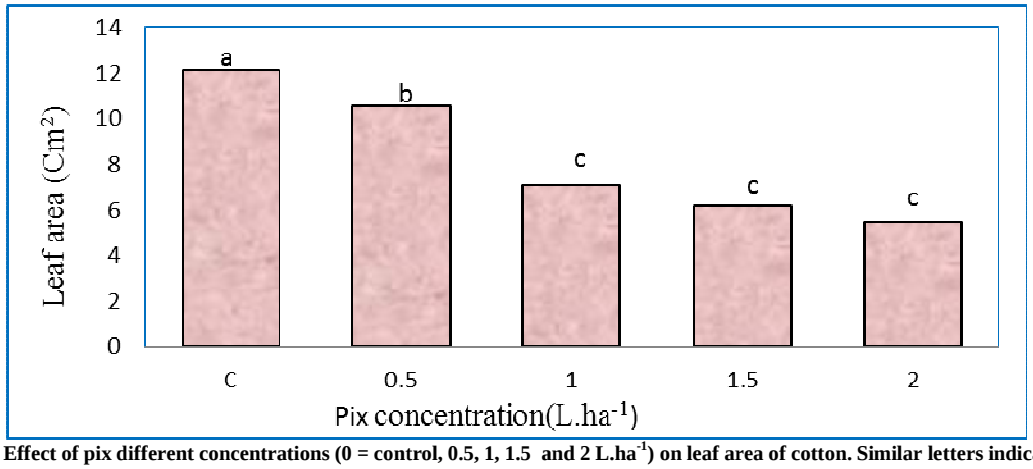

Fig 7: Effect of pix different concentrations (0 = control, 0.5, 1, 1.5 and 2 L.ha^{-1}) on leaf area of cotton. Similar letters indicate no significant difference in Duncan's test (P≤0.05)

DISCUSSION

The results this research indicated that pix different concentrations decreased stem length in comparison with control (fig1). Also, higher values of pix reduced shoot to root rate (fig 2) and nodes number (fig 3). Plant growth regulators like promoters, inhibitors or retardants play a key role in internal control mechanism of plant growth. Plant growth regulators decrease cotton vegetative growth by modifying the production of plant hormones such as gibberellins, auxins and cytokinins .Pix is an antigibberelin which decreases vegetative growth by reducing gibberellic acid formation, reduces plant height, that inhibits cell expansion but not cell division [11, 16, 20]. It was reported pix which is commonly used as growth retardant, when applied as foliar spray reduce the vegetative growth of plant [3, 4, 23].

Our results showed pix different treatments had not significant effect on root length of cotton (fig 1) Since the sensitivity of various organs to hormones is different [6]. It is likely the cotton root growth to concentrations used of pix in this experiment were not sensitive.

According to our finding pix application in 2L.ha-1 increased fresh and dry weight in leaf cotton. On the other hands fresh and dry weight of stem and root did not change significantly at different concentrations of pix (fig 4,5) . It has been reported pix through the enhancement of leaf parenchyma thickness and chlorophyll content, carbohydrates [19] and protein increased leaf dry weight [21].

As it was seen in fig 6 and 7 application of pix in concentrations difference decreased leaf number and leaf area in comparison with control. Souza and Rosolem [22] also observed a decrease in cotton leaf area when plants were

treated with this growth regulator .The researches showed that application of gibberellic acid cause increase the number and area of leaves in plants [1].Since pix is an antigibberellin [2], so cotton plants treated with pix have smaller leaves and Leaf number also is less than the control.

CONCLUSION

Manipulation of cotton plant architecture using plant growth regulators such as pix can be an agronomic strategy for obtaining high yields. The our results indicated that pix different concentrations decreased stem length, leaf number and leaf area in comparison with control .Also pix in concentration $2Lha^{-1}$ reduced shoot to root rate , nodes number and increased fresh and dry weight in leaf cotton. . On the other hand root length ,fresh and dry weight of stem and root did not change significantly at different concentrations of pix.

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