BOLLWORMS INFESTATION AND COTTON YIELD AS INFLUENCED BY WATER REGIME

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Abstract

Four experiments were carried out at Sakha Agricultural Research Station during 1995 and 1996 seasons to study the influence of four water regimes on cotton infestation by pink bollworm, *Pectinophora gossypiella* and spiny bollworm, *Earias insulana* as well as on cotton yield. The results indicated that the highest infestation by both insects was obtained when cotton plants were irrigated every two weeks throughout the growing season. The least infestation was for three week intervals. Also, larval population of both insects took the same trend .

Significant influence of irrigation intervals were found on both number of open bolls and seed cotton yield. The highest number of open bolls and cotton yield were recorded when cotton plants were irrigated every two weeks during vegetative growth stage and three weeks during fruiting stage. This water regime supplies the plants with sufficient water during vegetative stage, and keeps the water table at low level at fruiting stage. So, this treatment could be recommended to : (1) reduce bollworm infestation, (2) save water irrigation and (3) get higher cotton yield.

INTRODUCTION

Cotton is still an important commercial crops in Egypt, and occupies a prominent place in the national economy. The cotton plants are liable to be attacked by bollworms which are considered the most destructive cotton pests in Egypt.

It was found that Egyptian farmers usually irrigate cotton with water quantities more than its requirements. This over-irrigation raises the level of water table, and increases the moisture content in the zone of effective roots, which may lead to root-rot disease, reduction in root efficiency, and increase in damage of bollworms.

Management of cultural practices is one of the important factors reducing the insect populations. In Egypt, Mahrous (1977) studied the water use efficiency of cotton plants under different regimes of irrigation. Watson et al. (1978) investigated the effect of irrigation on yield, and on the number of the the pink bollworm larvae. Wilson and Caster (1991) reported that the yield loss was a result of insect damage.

Generally, the effect of agricultural practices of cotton crop on the infestation with different pests attracted the attention of many entomolgists such as (Leigh et al., 1970; Kittock and Pinkas, 1971; El-Shaarawy et al., 1974a; Abdel-Fattah et al.,1980; Abd El-Kader, 1980; Moawad and Hussein 1980; Slosser, 1980; El-Zanan, 1987; Hango and Uthamasamy, 1989; Sharma et al., 1989; Thangaraju and Uthamasamy, 1990; Nassef et al., 1996). The present investigation aims to throw more light, and clarify the effect of irrigation intervals on the rate of bollworms infestation, and estimation of the loss in cotton yield.

MATERIALS AND METHODS

The influence of water regime on cotton infestation by bollworms was studied in 1995 and 1996 cotton seasons of the experimental farm of Sakha Agricultural Research Station. Giza 85 cotton variety was sown on 16 plots (1/50 fed. each) arranged in a completely randomized block design (4 treatments of water regime x 4 replicates). Recommended agricultural practices were applied, but the following water regime was initiated after the second irrigation:

A- Every two weeks throughout the growing season, (Recommended, S.F. Cotton Extension Service, 1996).

B- Every three weeks throughout the growing season.

C- Every two weeks during vegetative stage followed by every three weeks during fruiting stage starting from the appearance of the first flower.

D- Every three weeks during vegetative stage followed by every two weeks during fruiting stage starting from the appearance of the first flower.

No insecticides were applied, but the egg-masses of the cotton leafworm, *Spodoptera littoralis* were handy picked. Weekly boll samples (25 bolls/plot) were collected and examined for bollworms infestation, beginning from boll formation till cotton harvest, and infested bolls were counted. Numbers of pink bollworm, *P.gossypiella* and spiny bollworm, *E.insulana* larvae occurring inside cotton bolls

were recorded accrding to Metwally's method (1974) for estimating the loss resulted from bollworms infestation.

Ten guarded plants were chosen at random from each plot to study the following characters: (a) number of open bolls/plant, (b) boll weight, (c) seed cotton yield per plant and (d) seed cotton yield per 1/50 feddan.

Obtained data were statistically analyzed according to procedures outlined by Le-Clerg et al. (1962), and the results were compared by using Duncan's Multiple Range Test (1955).

RESULTS AND DISCUSSION

1. Effect of irrigation intervals on the bollworm infestations and the losses in cotton yield

Data presented in Table 1 revealed the influence of water regime on both bollworm infestation and losses in cotton yield. The highest bollworm damage to cotton bolls resulted from treatment A (irrigation at 2-week intervals throughout the season). This treatment had the highest larval population in cotton bolls; 34.88 & 7.25 larvae/100 bolls, for *P.gossypiella*, and *E.insulana*, respectively. Also, percentages of infestation were the highest; 23.25% for pink bollworm, and 5.38% for spiny bollworm. Consequently, the losses in cotton yield reached its maximum value (13.25%). Prolonging irrigation intervals (3-weeks throughout cotton season) as indicated in treatment B reduced all parameters for both insects. For *P.gossypiella*, the lowest larval population and least infestation were recorded (27.50 larvae/100 bolls, and 14.38% infestation). Similar trend was recorded in case of *E.insulana*; 5.38 larvae/100 bolls, and 3.25% infestation. Also, the least value of yield losses (9.63%) was obtained. The second rank of damage was occupied by treatment D (irrigation at 3-week intervals during vegetative stage and at 2-weeks at fruiting stage). Populations of larvae were 31.50 and 6.88/100 cotton bolls, for pink and spiny bollworm, respectively. The corresponding values of infestation for both insects were 20.25 and 4.25%, respectively. On the other hand, yield loss was 12.38%. When the water regime was reversed in treatment C (irrigation at 2-week intervals at vegetative stage, and at 3-week intervals at fruiting stage), the damage of bollworms was relatively reduced. Values for *P.gossypiella* were 30.38 larvae/100 bolls, and 17.88% infestation, and those of *E.insulana* were 6.13 larvae, and 3.63% infestation. Yield loss resulting from cotton infestation by both insects was 10.50% .

It is worth to mention that average number of pink bollworm larvae (31.07 per 100 bolls) greatly exceeded that of spiny bollworm (6.41 larvae). Also, infestation due to the pink bollworm was higher than that of spiny bollworm; 18.94 and 4.13%, respectively.

Table 1. Effect of water regime on both bollworms infestation and losses in cotton yield (Sakha, 1995).

Treat.	Irrigation intervals		*P. gossypiella*		E. insulana		Total infestation %	Yield losses %
	At vegetative stage	At fruiting stage	No. of larvae/ 100 bolls	Infestation %	No. of larvae/ 100 bolls	Infestation %		
A	2-week	2-week	34.88 b	23.25 d	7.25 d	5.38 bc	28.63	13.25 c
B	3-week	3-week	27.50 a	14.38 a	5.38 a	3.25 a	17.63	9.63 a
C	2-week	3-week	30.38 ab	17.88 b	6.13 b	3.63 a	21.51	10.50 ab
D	3-week	2-week	31.50 ab	20.25 c	6.88 c	4.25 b	24.50	12.38 bc
Average	-	-	31.07	18.94	6.41	4.13	23.07	11.44

* Means followed by the same letter are not significantly different at 5% level

Data of 1996 for the same treatments are presented in Table 2. The same trend was found; the greatest population of bollworms larvae and highest infestation were recorded in treatment A, and lowest values were obtained in treatment B.The second rank was recorded in treatment D, while the third one was for treatment C.

These data coincided with those found by Moawad and Hussein (1980) and Bariola (1983) who mentioned that irrigation intervals greatly affected the population density of the overwintering larvae of *P.gossypiella* in cotton bolls. On the other hand, Helaly et al. (1994) reported that irrigation intervals had no significant effect on larval population of cotton pests, and on cotton yield as well. Ali et al. (1996) found that insect population were affected by different furrow-irrigation systems.

Table 2. Effect of water regime on both bollworms infestation and losses in cotton yield (Sakha, 1996).

From the current results, it could be concluded that cotton should be irrigated at 2-week intervals at vegetative stage, followed by 3-week intervals at fruiting stage, starting from the appearance of the first flower, to minimize bollworm infestation and maximize cotton yield.

2. Effect of irrigation intervals on growth and yield components

Data presented in Table 3 show the significant influence of irrigation intervals on both number of open bolls and seed cotton yield per plant. The highest numbers of open bolls were recorded for treatment C (2-week intervals at vegetative, and 3-week intervals at fruiting), being 8.0 and 12.4 bolls in 1995 and 1996, respectively. Also, the same treatment appeared as the best in cotton yield; 17.6 and 28.5 g of seed cotton yield/plant for 1995 and 1996, respectively. This may be attributed to that this treatment supplied the cotton plants with their suitable water requirements at vegetative stage (irrigation at 2-week intervals) since evaporization from soil surface was high, and thus close irrigations were needed to avoid soil dryness. At fruiting stage, the cotton canopy become greater, and the soil surface is shaded, so the evaporation is minimized. Also, this treatment (C) contributed in saving water irrigation, and in reducing the water table at this sensitive stage of growth which help in avoiding the damage to cotton roots.

Table 3. Effect of irrigation intervals, on growth and yield components of Giza 85 cotton cultivar (Sakha, 1995 & 1996).

Treat.	Irrigation intervals		No. of open bolls/plant		Boll weight (g)		Seed cotton yield/plant		Seed cotton yield per 1/50 fed. (kg)	
	At vegetative stage	At fruiting stage	1995	1996	1995	1996	1995	1996	1995	1996
A	2-week	2-week	6.7 a	9.0 a	2.1	2.2	14.1 b	19.8 a	16.8 b	20.4 a
B	3-week	3-week	6.6 a	11.6 ab	2.0	2.1	13.2 a	24.4 b	14.3 a	19.7 a
C	2-week	3-week	8.0 a	12.4 b	2.2	2.3	17.6 c	28.5 d	19.5 c	23.9 b
D	3-week	2-week	7.0 a	12.1 b	2.1	2.2	14.7 ab	26.6 c	17.1 c	22.3 b

* Means followed by the same letter are not significantly different at 5% level

The current results are in agreement with those of Radin et al. (1989) who reported that yield of seed cotton increased as the intervals between water applications were decreased if the total amount of water applied was unchanged. Also, treatment (c) had significant effect on number of open bolls/plant which reflected on cotton yield per plant and plot.

REFERENCES

1 . Abdel-Fattah, M.I., M.M. Hosny and G. El-Saadany. 1980. The spacing and density of cotton plants as factors affecting populations of the bollworms, *Earias insulana* (Boisd.) and *Pectinophora gossypiella* (Saund.). Bull. Ent. Soc. Egypt, 60 : 85-94.

2 . Abd El-Kader, A.E.M. 1980. Effect of planting date and watering regime on yield and quality of cotton. M.Sc. Thesis, Fac. Agric. Assiut Univ. Egypt.

3 . Ali, S.A., H.M. Abou-Zeid and A.M. Hamid. 1996. Effect of different furrow irrigation systems on cotton productivity, water use efficiency and some insects population. J. Agric. Sci. Mansoura Univ. 21 (1): 69-77.

4 . Cotton Central Administration of Agricultural Extension. 1996. Ministry of Agric., Cairo, Egypt. Bull. 266: 47.

5 . Duncan, B.D. 1955. Multiple Range and Multiple F-tests. Biometrics. 11 : 1-42.

6 . El-Zanan, A.A.S. 1987. Studies on the bollworms; Effect of certain agricultural practices on the degree of bollworms infestation with determination to the loss of the cotton yield. Ph. D. Thesis Fac. of Agric Kafr El-Sheikh. Tanta Univ., Egypt.

7. Hango, K. and S. Uthamasamy. 1989. Influence of spacing and fertilizer levels on the incidence of bollworm-boll rot complex in three varieties of cotton (*Gossypium hirsutum*). J. of Applied Agriculture Research, 4 (3) : 173-178. [C.F. R.A.E. 78 (9), Abst. No. 8780].

8. Helaly M.M., S.S.M. Hassanein, E.M. Metwally, W.M.H. Desukey and H.M.H. Al-Shannaf. 1994. Effect of certain agricultural paractices on the population density of some cotton pests. Zagazig, J. Agric. Res. 21 (6): 1817-1828.

9. Kittock, D.L. and L.L.N. Pinkas. 1971. Effect of pink bollworm on cotton seed and fibre. Cotton Growing Review 48 : 210-217.

10. Le-Clerg, E.L., W.H. Leonard and A.G. Clark. 1962. Field Plot Technique Burgess, Minnaplies 2nd Ed.

11. Leigh, T.F., D.W. Greemes, H. Yanabo, D. Bassett and J.R. Stockton. 1970. Insects in cotton as affected by irrigation and fertilization practices. California Agric. J. 24 (3) : 1414 [C.F. R.A.E. 62 (4), Abst. No 1524).

12. Mahrous, F.N. 1977. Effect of irrigation standards under some cultural practices on cotton growth and yield. Ph.D. Thesis, Fac. of Agric. Tanta Univ., Egypt.

13. Metwally, A.G. 1974. Estimation of loss caused by cotton bollworm in governorates of Egypt. Ministy of Agric. Research Institute of Plant Protection Division of Bollworms.

14. Moawad, G.M. and A.H.M. Hussein. 1980. Effect of certain agricultural practices on the population density of the overwintering pink bollworm, *Pectinophora gossypiella* larvae (Lepidoptera, Gelechiidae). Agric. Res. Rev., 58 (1) : 265-276.

15. Nassef, M.A., A.A. El-Feshawi, K. Gouher, A.A. S. El-Zanan and W.M. Watson. 1996. Seasonal abundance of pink bollworm *Pectinophora gossypiella* (Saund.) as influenced by cotton planting dates and prevailing weather factors. J. Agric. Res. Tanta, Univ. 22 (1) : 82-87.

16. Radin, J.W., J.R. Mauney and P.C. Kerridge. 1989. Water uptake by cotton roots during fruiting filling in relation to irrigation frequence. Crop. Sci. 29 (4) : 1000-1005.

17. Shaarawy, M.F., G. El-Saadany and S.A. Elafie. 1974a. Determination of the loss in cotton yield as being affected by the pink bollworm, *Pectinophora gossypiella*. 2nd Egypt Pest Cont. Cong., Alexandria: 282-287.

18. Sharma, P.K., M. Singh and A.K. Dhawas.1989. Management of boll worm in *Gossypium orboreum* L. through nutrient and irrigation in Punjab. Journal of Research. Punjab Agricultural University. 26 (2) : 204-205 [C.F. R.A.E. 78 (7); Abst. No 6973].

19. Slosser, J.E. 1980. Irrigation timing for bollworm management in cotton. J. Econ. Entomol., 73: 346-349.

20. Thangaraju, D. and S. Uthamasamy. 1990. Studies on the ecology and monitoring of pink bollworm, *Pectinophora gossypiella* (Saunders) on cotton. Madras Agricultural Journal. 77 (3-4): 161-164 [C.F. R.A.E. 81 (9), Abst. 9138].

21. Watson, T.F., F.M. Carasso, D.T. Langston, E.B. Jackson and D.G. Fullerton. 1978. Pink bollworm suppression through crop termination. J. Econ. Ent. 71 (4): 638-641.

22. Wilson, L.T. and F. Carte. 1991. Leaf feeding insects and mites. Cotton physiology today Newsletter of the Cotton Physiology Education Program-National Cotton Council, 2 (8).

تأثير فترات الرى على معدل الاصابة بديدان اللوز وكمية المحصول الناتج

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تم اجراء اربعة تجارب بالمزرعة البحثية بمحطة البحوث الزراعية بسخا خلال موسمى ١٩٩٥، ١٩٩٦ لدراسة تاثير فترات الرى خلال مرحلتى النمو الخضرى والثمرى على الاصابة بديدان اللوز القرنفلية والشوكية وكذلك كمية المحصول، وكانت المعاملات على الوجة التالى :

١ - الرى كل اسبوعين خلال فترة النمو (الخضرى - الثمرى).

٢ - الرى كل ثلاثة اسابيع خلال فترة النمو (الخضرى - الثمرى).

٣ - الرى كل اسبوعين خلال مرحلة النمو الخضرى ثم الرى كل ثلاثه اسابيع خلال مرحلة النمو الثمرى ابتداء من تفتح اول زهرة.

٤ - الرى كل ثلاثة اسابيع خلال مرحلة النمو الخضرى ثم الرى كل اسبوعين خلال مرحلة النمو الثمرى ابتداء من تفتح اول زهرة.

وقد نفذت هذه المعاملات بعد الرية الثانية. واظهرت النتائج ما يلى :

١ - أن أعلى اصابة بدودتى اللوز (٢٨,٦٣٪) وكذا أعلى عدد من المحتوى اليرقى للقرنفلية والشوكية (٣٤,٨٨ ، ٧,٢٥ يرقة / ١٠٠ لوزة) على الترتيب عندما استخدمت المعاملة الاولى (الرى كل اسبوعين) وان اقل اصابة (١٧,٦٣ ٪) واقل محتوى يرقى (٥,٣٨،٢٧,٥٠ يرقة / ١٠٠ لوزة) على الترتيب عندما استخدمت المعاملة الثانية.

ب - ان هناك فروق معنوية بين المعاملات المختلفة وبعضها فى كل من عدد اللوز المتفتح (٨,٠ ، ١٢,٤ لوزة / نبات) واعلى محصول من القطن (١٧,٦ ، ٢٨,٥ جم /نبات) قد تم الحصول عليه من المعاملة الثالثة (رى القطن كل اسبوعين خلال فترة النمو الخضرى وكل ثلاثة اسابيع خلال فترة النمو الثمرى).

جـ - لوحظ انه عند تطبيق المعاملة الثالثة فان النباتات تأخذ احتياجاتها من ماء الرى وتحافظ على مستوى الماء الارضى الى اقل حد خلال مرحلة الاثمار، لذا فان هذه المعاملة يمكن التوصية بها حتى يمكن تقليل الاصابة بديدان اللوز وتوفير ماء الرى والحصول على أعلى انتاجية من محصول القطن.