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Effect of Synthetic Urea on the Population Dynamics of Sucking Insect Pests of Cotton

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Research Article

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Abstract

Cotton is an important cash crop of Pakistan. Different biotic and abiotic factors are deteriorating the quantity and quality of the cotton directly or indirectly. From the biotic factor, sucking insect pests are most important because they lowering the photosynthetic activity of plants and also act as a vector of the disease-causing pathogen. Therefore, the experiment was conducted to evaluate the effect of synthetic urea on the population dynamics of sucking pest of cotton in Pakistan during 2016. Cotton plants were sown the filed under randomized complete block design (RCBD) with three replicates. Data were collected on a weekly basis and analysed through statistics 8.1. ANOVA of the population of sucking pests indicated that urea fertilizer significantly fluctuated the population of the cotton jassid, whitefly. Moreover, Duncan,s Multiple Range tests indicated that the population of sucking pests have elevated at the maximum level of urea fertilizer. This study would be helpful for the farmers for the appropriate use of fertilizer for crop production as well as crop protection.

Keywords: Sucking Pest; Population Dynamics; Cotton pest; Effect of urea on sucking pest

Introduction

Agriculture made meaningful production during 2014-15 and showed a growth of 2.9% as compared to 2013 when this growth was 2.7% in all agriculture sectors and subsectors [1]. Cotton, *Gossypium hirsutum* L. (Family: Malvaceae) commonly known as "White Gold". It is commercially important due to its fibre quality. It is grown in temperate and tropical regions as an annual cash crop. In Pakistan Cotton act as a backbone of the textile industry because it is a natural fibre crop [2,3]. Pakistan is the 4th biggest producer of cotton in the world [4]. Cotton contributes 1% GDP overall while 5.1% GDP in Sector in Pakistan. According to the economic survey of Pakistan 2016-17, the cotton production during 2016-17 was about 10.671 million bales and the total area under cotton cultivation was 2.917mha [5]. There are several biotic and abiotic factors which affect the yield of the cotton crop [6]. Among these factors, insect attack is the prominent one [7,8]. There are about 150 mite and insect pests in Pakistan which affect the cotton crop [9,10]. The high population of sucking insect pests and bollworms

that survive every year, even though a massive use of insecticides on cotton cause about 45% of crop loss in some areas of the country [11,12]. Among these insects jassid *(Amrasca devastans* Dist.), whitefly (*Bemisia tabaci* Genn.), thrips (*Thrips tabaci* Lind.) and aphid (Aphis gossypii Clov.) are very severe sucking insect pests. Whitefly is the main pest of transmission of cotton leaf curl virus (CLCV) [13]. It is a highly destructive disease in cotton which causes a great reduction in yield. It also reduced the photosynthetic activity of the plant. Whitefly acts as a vector in the disease spreading [14]. About 200 species of viruses are spread by whiteflies but *Bemisia tabaci* transmits 111 species of viruses in various plants [15]. It is reported that Whitefly spread more than 70 diseases in plants by suckling process. A serious reduction in yield is noticeable on cotton, cassava, bean, cowpea, sweet tomato cucumber, tobacco peeper, squash and papaya [16]. Thrips are another major damaging pests of cotton which affect the seedling stage. If their population remains unchecked, it will ultimately cause the death of seedlings. This pest has a negative correlation with rain [17,18]. Jassids affect the foliage of the crop by feeding on the cell sap and inject their toxic saliva into a plant which results "hopper burn" [19]. Aphid and Jassid affect the photosynthetic activity as well as they also reduce the crop by reducing the nutrient uptake activity [20]. There is a huge economic loss caused by the insect pests to the economy of Pakistan that's why we have adopted some precautionary measures like; spray of insecticides, pesticides etc. to overcome these losses [21,22]. These precautionary measures somehow beneficial to overcome losses but at the same time, these are harmful to human beings indirectly by polluting the environment [23]. So it is necessary for the benefit of humans and the environment to use a certain level of fertilizer, genetically modified crops against insects to avoid chemical sprays and development of insect pest management strategy by the entomologists.

Materials and Methods

The experiment was conducted at the postgraduate agriculture research centre, University of Agriculture Faisalabad Pakistan in 2016S to find out the effect of different levels of urea fertilizer (50, 100, 150 and 200 kg/hectare) on the population dynamics of sucking insect pests of cotton. Through standard agronomic practices, cotton plants were sown in the field by applying Randomized Complete Block Design with three replications. Treatments were applied in two splits, one at the time of sowing and other at the flowering stage. The Data was recorded regarding the sucking insects viz., Jassid (*Amrasca devastans* Dist.), Whitefly (*Bemisia tabaci* Genn.) and Thrips (Thrips tabaci Lind.) in the months from 1st week of July to 2nd week of September. The statistical analysis was done through mStat Package. The means were compared by the DMR Test at P=0.05.

Results

Dynamics of Sucking Insect Pests of Cotton With Respect to Urea Application

An experiment was conducted to evaluate the different levels of urea fertilizer on the population density of sucking insect pest of cotton under field condition. Analysis of variance at P ≥ 0.01 for the data indicated that urea fertilizer has a significant effect on the population density of the sucking insect pests of cotton (Table 1). Linear line in bar graph represent that as the level of urea fertilizer increases, the population of insects was increased (Figure 1). Maximum population of jassid, whitefly and thrips (5.49, 30.05 and 11.14/leaf respectively) were observed on those plants where maximum urea (200 kg/hec) was applied (Figures 1,1b & 1c) and minimum density of jassid, whitefly and thrips (2.93, 18.31 and 5.66/leaf respectively) was seen at low level (50kg/hec) of urea fertilizer (Figures 1a-1c). Means of insect populations were compared by Duncan,s Multiple Range (DMR) test which indicated that maximum level of urea (200 kg/hec) gave significantly different results from all other levels of urea at P ≥ 0.05. At this level peak population of sucking insect pests were noted (Figures 1a-1c). Means sharing similar letters are not significantly from each other (Figure 1).

SOV	D.F	F. Rato for Jassid	F. Ratio for Whitefly	F. Ratio for Thrips
Replication	2	0.40 NS	0.35 NS	0.17 NS
Dates (D)	9	27.68**	226.34**	163.99**
Urea levels (U)	3	37.84**	64.53**	30.95**
DXU	27	1.81**	2.39**	1.89**
Error	54			

*= Significant at P ≥ 0.050. ** = Significant at P ≥ 0.01

Table 1: Analysis of variance of the data regarding sucking insect pests of cotton, Urea levels and at various dates of observation.

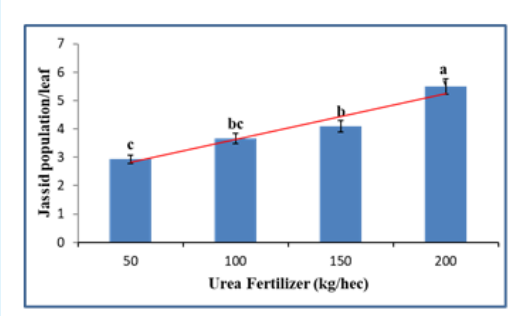

Figure 1a: Jassid Population on cotton at different levels of urea

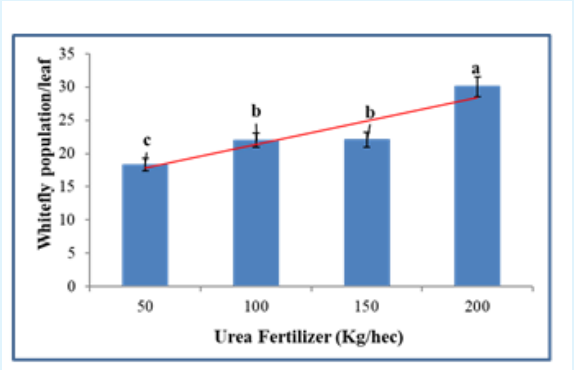

Figure 1b: Whitefly population on cotton at different levels of urea

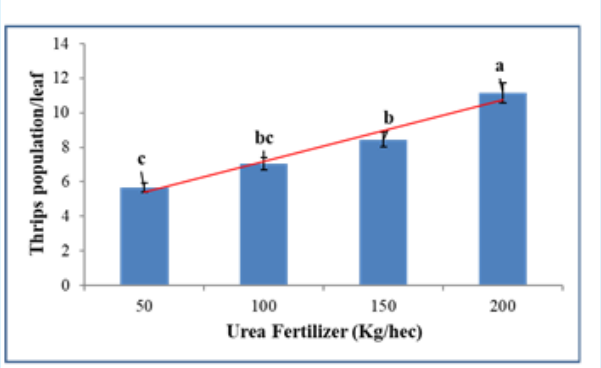

Figure 1c: Thrips population on cotton at different levels of urea

Dynamics of Sucking Insect Pests during Growth Period

Analysis of variance of the population of sucking insect pest recorded on different dates was done. ANOVA represented the highly significant effect of date of observation on the population fluctuation of sucking pest of cotton which may be due to the temperature, humidity or due to the growth of plants (Table 1). Their means were compared by the DMR test at α = 0.05. The peak value of jassid was observed at the start of July while the minimum population was noted in September. The linear line in graph indicated that as the plant grows the population of the jassid, whitefly and thrips decreases (Figures 2a-2c). Irregular increase in the population of whitefly and thrips might be due to the increase in humidity due to rainfall.

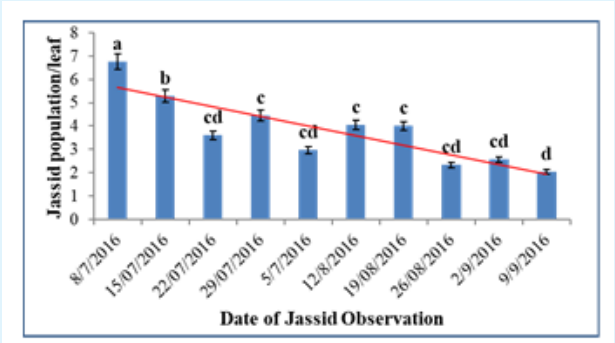

Figure 2a: Jassid population on cotton at different dates of observation

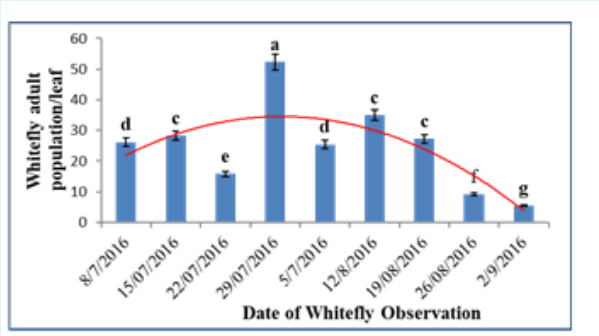

Figure 2b: Whitefly population on cotton at different dates of observation

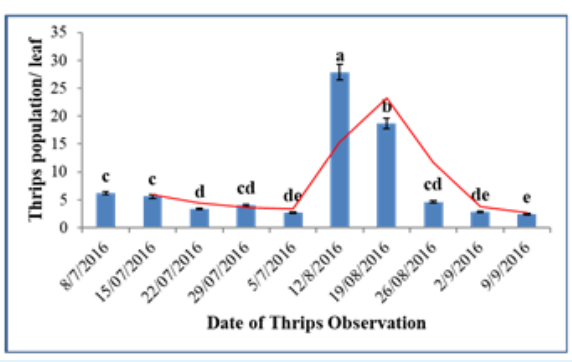

Figure 2c: Thrips population on cotton at different dates of observation

Discussion and Conclusion

Sucking insect pests are severe pests of cotton affecting vegetative, seedling, fruiting and flowering stages [24]. The present study also observed the effect of different levels of synthetic urea fertilizer on the population fluctuation of sucking insects pests of cotton. Rate of urea fertilizer gave a positive response towards the population density of sucking insect pests of cotton. As the amount of urea increases the population of sucking pests were also increased. The study of Natarajan and Muhammad and Anjum also showed that sucking insects cause a lot of damage to the cotton crop [25,26]. The damaging effect was also reported by Suhail et al., in Bt cotton line (IR-FH-901) [27]. In the present study nitrogen level effects the pest population, as in the highest level of nitrogen application shows the highest growth rate and vice versa (Figures 1a-2a). The similar results were also combined with Aqueel and Leather [28]. Cisneros and Godfrey, 2001 also observed the increase rate of insects pests by the increase of nitrogen level [29]. The same observations also studied in other crops like Wheat and Barley [30,31]. Nevo and Coll also reported the Positive behaviour of sucking insect pests in increased nitrogen level [32]. According to the observations, a lot of fluctuations were observed in the population of sucking insect pests. As data revealed that the Jassid population was at a peak in the first week of July (Figure 1b) while in the case of Whitefly the favourable time period for pests was the last week of July (Figure 2b). Thrips showed variant behaviour and gave the highest peak of population in August (Figure 2b). These findings showed that different insects have different optimum growth period. July was favourable for Jassid and Whitefly while August was suitable for Thrips. These findings were supported by the study of Arif, et al. as they resulted that the insect population in different varieties had peaks of growth in June and July [33].

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