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Different Regimes of Nitrogen and Invasion of Thrips on Onion in Balochistan, Pakistan – I

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Abstract: To determine the relation between fertilizer and thrips infestation in onion (*Allium cepa*), six different levels of nitrogen (N) with constant phosphorus (P) and potassium (K) were tried in, Quetta, Balochistan, Pakistan. The soil of the region is sandy loam, alkaline, moderate in calcium and very poor in NPK. The soil and climate are well suited for onion cultivation. Low and optimum doses of nitrogen have no effect on thrips population. Maximum mean total thrips infestation (267.9 and 269.3 per plant) was observed at high doses of nitrogen application (200 and 250 Kg ha^{-1}). Crop yield has shown direct relations with increased fertilizer doses up to 200 Kg ha^{-1} nitrogen. Beyond that dose a rapid decline in yield was observed. Maximum yield (15220 Kg ha^{-1}) and cost benefit ratio (1: 1.44) with minimum mean total thrips infestation (157.2) was observed by applying 150-100-100 Kg ha^{-1} NPK, respectively.

Key words: Onion, thrips, NPK, IPM, Quetta, Balochistan

Introduction

Onion is a cash horticultural produce of the province of Balochistan. It is grown over an area of 28010 ha with an average producing capacity of 19.62 ton ha^{-1} (Anonymous, 1999-2000).

Cantisano (1999) reported thrips, the main trouble causing insect pest of onion in many regions of the world. Thrips are the most damaging arthropod pest of onion in the Balochistan too (Hazara *et al*., 1999). Stoller (1999) reported that thrips attack on new leaves of onion because those leaves have phloem only. Phloem tissues are rich in amino acids and amines. The phloem feeding phytophagous insects, like thrips, prefers tissues rich in nitrogen (Dixon, 1970; McNeill and Southwood, 1978; Mattson, 1980; McClure, 1980 and Scriber, 1984). Rateaver and Rateaver (1993) reported that for any IPM (Integrated Pest Management) program of thrips, the soil fertility must be considered along with other factors. High nitrates in plant sap invite thrips (Cantisano, 1999). Islam and Adams (2000) reported that the plant species found in the rangeland of Balochistan are deficient of N means the soil of the region is deficient in N as well.

Khan *et al*. (2000) reported that in Pakistan, mainly NPK are used as nutrient supplements. Fertilizers provide plants with more nutrients (Bogenschutz and Konig, 1976; Bentz *et al*., 1995) as a result of which the plants not only get lush green color but also enhances the accumulations of nutrients in the shoot, which attracts phytophagous insects (Natarajan, 1986). Use of fertilizer not only affects the nutritive value of plant but also impacts on the life style of the insect pests (Dowell and Steinberg, 1990; Bentz and Larew, 1992). By adjusting proper doses of fertilizers the population of phytophagous insects could be controlled, thus proper use of NPK fertilizers can be used as a good tool in the IPM program of thrips in onion. Keeping in view the above discussion this study was determine if use of NPK, specifically nitrogen, effect the thrips infestation in onion if so than what is the best optimal dose of NPK for the minimal infestation of the said pest.

Materials and Methods

Effects of six different levels of nitrogen with constant phosphorus and potassium (NPK), on thrips population, were evaluated in onion (*Allium cepa*) at Quetta, Balochistan during 2001. The trial was conducted around the recommended dose of NPK fertilizers. Agronomy Section, Agriculture Research Institute (ARI), Quetta recommends 150-100-100, NPK Kg ha^{-1} respectively for onion for the region. Thus following six different N with constant P and K levels was tried:

T1 Control (00 – 00 – 00, NPK Kg ha^{-1} respectively)
T2 (50 – 100 – 100, NPK Kg ha^{-1} respectively)
T3 (100 – 100 – 100, NPK Kg ha^{-1} respectively)
T4 (150 – 100 – 100, NPK Kg ha^{-1} respectively)
T5 (200 – 100 – 100, NPK Kg ha^{-1} respectively)
T6 (250 – 100 – 100, NPK Kg ha^{-1} respectively)

Urea (46% N), Single Super Phosphate, SSP (18% P_2O_5) and Murite of Potash, MOP (60% K_2O) fertilizers were purchased from the local market and were used for NPK

respectively. Treated and certified seeds of Chiltan - 89 were obtained from the Agronomy Section, Agriculture Research Institute (ARI), Quetta. A well-prepared piece of land was divided into 8 x 10 m^2 plots in Randomized Complete Block Design (RCBD) with four replications. The seeds were broadcasted @ 15 Kg ha^{-1} in March. The calculated doses of the said fertilizers were applied in a single dose except Urea. Urea fertilizer was applied in split doses, half at the time of sowing and the other half after eight weeks because the nitrogenous fertilizers are not only leach down very fast but also have high evaporation capability. At the time of sowing there are no roots hence most of the fertilizer could not be utilized and is applied when the plants get their roots (Ali, 2001; Hadi, 2001; Hassan, 2001). All other agronomic practices including eradication of weeds were kept constant. Weeds have a strong competition with onion (Hassan and Malik, 2001 a, b; 2002) and may effect on thrips population as alternate host (Hafeez, 2001). Crop was irrigated regularly by tube-well. Prior to the application of fertilizer the soil test was done in the Chemistry and Soil Fertility Section, (ARI), Quetta. Observations for thrips population were taken weekly from five randomly selected plants from each replication till the digging of the crop.

Data were analyzed by the Microcomputer Statistical Program for Experiments, Designs and Analysis (Russell, 1992). Analysis of Variance (ANOVA) was constructed to test the significant differences between the variables. Least Significant Difference (LSD) test was applied to differentiate the means.

Table 1: Pre-sowing soil physico – chemical characteristics of experimental trial site at 0 - 30 cm depth during 2001

Soil Characteristics	Values
Clay	11.1 %
Silt	34.2 %
Sand	54.7 %
Texture Class	Sandy Loam
PH	8.24
Total Soluble Salt	0.098 %
$CaCo_3$	20.57 %
Organic Mater	1.6 %
Total Nitrogen	0.098 %
Available Phosphorous	14 ppm
Available Potassium	187 ppm
Cation Exchange Capacity	8.7 meq/100 g soil

Table 2: Effect of six different levels of N with constant P and K on mean total thrips population in onion at Quetta, during 2001

Treatments	Thrips Population	% Increase
T1 (00-00-00)	155.6b*	00.00
T2 (50-100-100)	155.2b	- 0.206
T3 (100-100-100)	155.3b	- 0.142
T4 (150-100-100)	157.2b	1.079
T5 (200-100-100)	267.9a	72.26
T6 (250-100-100)	269.3a	73.16

* Lower case letters indicates significant difference down the column using LSD test value 5.552 at 5% level

Table 3: Effect of six different levels of N with constant P and K on mean total onion yield and cost benefit ratio at Quetta, during 2001

Treatments	Yield (Kg ha^{-1})	% Increase	CBR
T1 (00-00-00)	10470c*	00.000	0.0000c
T2 (50-100-100)	11100b	6.005	0.2500b
T3 (100-100-100)	11390b	8.775	0.3175b
T4 (150-100-100)	15220a	45.35	1.4380a
T5 (200-100-100)	11070b	5.718	0.1625bc
T6 (250-100-100)	9283d	- 11.35	-0.290d

* Lower case letters indicates significant difference down the column using LSD test. LSD values, at 5% level, for yield and CBR were 559.90 and 0.1783 respectively.

Results and Discussion

Table 1, explains the soil analysis of the experimental site before sowing of the crop. Soil fertility management affects thrips infestation and damage thus must be considered along with other factors for IPM of thrips (Rateaver and Rateaver, 1993). The soil is sandy loam in nature, which is supposed to be the best soil for the cultivation of horticultural varieties (Malik, 1994). The soil is aerated and drained well thus provides the most suitable anchorage to onion bulbs for growth (Ali, 2001). The soil of the region has enough calcium (20.57 % $CaCo_3$). Lack of adequate soil calcium may invite higher population of thrips (Rateaver and Rateaver, 1993). The soil is alkaline in nature and was very poor in NPK. Kakar *et al.* (2001) also reported that most of the soils of the province are deficient in nitrogen and phosphorus. The application of NPK must be calculated according to the condition of the soil. Madan and Sandhu (1985), Ghaffoor *et al.* (2003) recommended 120–50–50 NPK Kg ha^{-1} for the best growth of onion for soil moderate in NPK. Agronomy Section, ARI, Quetta recommends higher dose of NPK (150–100–100 NPK Kg ha^{-1} respectively) because soil is of poor texture.

Table 2, depicts the influence of different doses of N with constant P and K levels on thrips population. No effect was observed on the thrips infestation up to T4. T5 and T6 had maximum nitrogen and also got maximum thrips infestation (267.9 and 269.3 respectively). That means low and optimum doses of nitrogen have no effect on thrips population while high doses of N invites more thrips. Though T1, T2 and T3 are statistically at par to the recommended dose T4 but are slightly lower which reflects the idea of hamper population of the said pest at lower doses of nitrogen.

The repose for NPK is different in terms of crop yield (Table 3). Crop has shown direct relation to the increased fertilizer doses up to T5. Maximum fertilizer was applied in T6 (250-100-100) but minimum yield (9283 Kg ha^{-1}) was obtained. For proper growth of any plant optimum dose of nutrients is very important (Nashrin *et al.*, 2002). The

excessive doses of fertilizer might causes disturbance in physiological activities of the plant that affects adversely to the yield (Mehdi *et al*., 2001). There was not any significant difference in thrips population in T1 to T4 but the yield is significantly different means fertilizer had no effect on the population of thrips up to an optimal level but if the doses are increased than normal the infestation had a rapid increase too. On the other hand high doses of fertilizer are not economical (Table 3). The best cost benefit ratio was calculated for T4 (1: 1.44).

On the basis of the results it was clear that thrips are not the thread if the fertilizers are used in low or optimal doses. In the specific soil conditions as described in Table 1, 150-100-100 NPK Kg ha^{-1} respectively, is the best suited fertilizer dose for onion, regarding thrips infestation, crop yield and CBR.

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