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Impact of quantities of Nitrogen application on infestation of Sorghum insect pest

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Abstract

Sorghum [Sorghum bicolor (L.) Moench] is a vital essential nutriment crop in the biosphere and fifth most significant cereal crop afterward wheat, rice, maize and barley. NPK are elementary nutrients for plant development, which play a major role in uptake and energy creation in plants and suggestively improve the grain harvest. Sorghum is grown in a variety of agro-ecosystems, with varied biotic and abiotic variables influencing grain output. Arthropods are a serious difficulty for increasing sorghum yield among the biotic components. A variety of variables contribute to insect pest issues in the field, including alteration of the environment to make it more conducive to insect growth, reproduction, and development, as well as conventional cultural practises. Choosing pest-resistant cultivars that are well matched to local growing circumstances is the first step in integrated insect control in sorghum. This strategy is usually employed in conjunction with crop rotation, optimal planting date, trap cropping, cultivation of allelopathy or non-host crops, crop residue eradication, and field cleaning. Extant review has been made to cite the relevant literature on Impact of quantities of Nitrogen use on infestation of Sorghum insect pest.

Keywords: *Infestation, Sorghum, Fertilizers, Insect Pests*

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Introduction

Sorghum [Sorghum bicolor (L). Moench] is well improved to subtropical and temperate areas of the world and used in dissimilar ways in numerous countries. The United States, Nigeria, India, Mexico, Sudan, and Argentina are the top sorghum producers. In 2018, global sorghum output totaled 59.34 million tonnes on 42.14 million hectares, with a productivity of 1.40 tonnes ha-1 (FAOSTAT, 2020). After rice, wheat, and corn, sorghum is India's fourth most important cereal. and it is grown on average 4.80 million ha^{-1} with production of 4.40 million tonnes and productivity 917 kg ha^{-1} (IPAD, 2020). Sorghum is a key food, feed, fodder, and fuel source. Green fodder, hay silage, and pasture are made from the stem and leaves. Grain is mostly used for food, and is found in flat breads, cookies, cakes, and porridges. It is an important component of both cow and poultry feed. Syrup, jiggery, beer, and bio-fuel are some of the products made from sweet sorghum (ethanol). Sorghum is grown in a variety of agro-ecosystems, with varied biotic and abiotic variables influencing grain output. Arthropods are a serious difficulty for increasing sorghum yield among the biotic components. In diverse agro-ecosystems, around 150 bug species have been recorded to harm sorghum (Jotwani et al., 1980). Shoot flies (Atherigona soccata Rondani), stem borer (Chilo partellus Swinhoe), ear head bug (Calocoris angustatus Leth.) and ear head worm (Cryptoblebes gnidiella Mab.) are among the most common insect pests that attack at various phases of crop development. Insect damage cost roughly 32.2 percent of the grain production, according to Borad and Mittal (1983). On a national scale, the shoot fly has been found to generate a 5% loss on average (Jotwani, 1983). Stem borer infestation has resulted in yield reductions of 55 to 83 percent in northern India (Jotwani et al., 1971). Annual losses from panicle bugs are projected to be above Rs. 972 million (Leuschner and Sharma, 1983). Traditional cultural practises, indiscriminate use of chemicals (insecticides), and uneven use of fertilisers are only a few of the variables that contribute to insect pest issues in the field (Karimullah et al., 1986). NPK are essential nutrients for plant growth and development, since they aid plant metabolism and energy generation while also increasing grain yield. A review of present investigation has been made to cite the relevant literature on Studies on incidence of pests of sorghum affected by different quantities of nitrogen application in timely sown crop.

Nitrogen application on Sorghum insect pest

The impact of sowing date and fertiliser application on the incidence of the sorghum stem borer was studied, and the results revealed no interaction between fertiliser and sowing dates, as well as no influence of fertiliser on the incidence of the stem borer, according to Hali and Hofsvang (2001). According to Pandey (2003), larger nitrogen doses (120, 160, and 180 kg ha-1) resulted in more insect damage. The increase in infestation was related to the amount of nitrogen present. The whorl maggot infestation was maximum without N application and minimum with highest level of N. Ananda and Patil (2005) observed that the data on grain production and quality metrics vary greatly depending on zinc, iron, and nitrogen treatment timing. When nitrogen was administered in three splits, grain yield was considerably greater than when nitrogen was supplied in two splits.

The special effects of application N and P nourishment application on the biological development of insect of sorghum, evaluated by Bortoli *et al.* (2005). Treatments included: N: K at 0:200, 50:200, 100:200, and 200:200 and 400:200 ppm. N rates from 50 to 200 ppm resulted in normal development of the pest and the lowest rate resulted in the lowest crop damage percentage. The highest K rate is favourable for caterpillar development. Wale et al. (2006) investigated the impact of nitrogen fertiliser on stem borer insect attack and production losses in sorghum. Increasing quantities of Nitrogen fertiliser, i.e. 0, 41, 64, and 87 kg ha-1, were observed to enhance pest density, plant growth, and damage variabilities. The findings showed that using N fertiliser as an IPM strategy to control cereal stem borers is profitable. It has been determined that nitrogen fertiliser reduces the influence of borers on grain yields.

When comparing high nitrogen fertiliser rates to low nitrogen fertiliser rates, the millet crop survived and the subsequent crop was destroyed due to an increased borer population expanded (Tanzubil et al., 2006). According to Dash et al. (2007), increasing NPK dosages enhanced the degree of yellow stem borer damage. Regardless of variety or pesticide treatment, the nutritional level of 60:30:30 kg NPK ha-1 with $ZnSO_4$ resulted in the lowest borer incidence. The influence of nitrogen levels (0, 50, 75, and 100 kg/ha) on sorghum genotypes was investigated by Singh et al. (2007 a, 2007 b). The genotypes UTFS-43, HC 308, and SU 1080 had considerably greater plant height, green and dry fodder yields, according to the results. Over the control and N 50 kg ha-1 nitrogen levels, 75 kg ha-1 had considerably higher values in the above-mentioned metrics.

Effects of varying nitrogen levels (0, 80, 100, and 120) and nitrogen treatment on rice insect incidence Ramzan et al (2007). The treatment where N was not applied at all had the lowest proportion of stem borer infection, but the yield was also negatively affected. The crop with 120 kg N ha-1 had the highest insect pest vulnerability. With a higher level of nitrogen (100 kg ha-1), the yield remained stable, and at 120 kg ha-1, it began to decline but stayed constant. Because excessive N makes plant tissues sensitive to pest attack, optimising the level of N in relation to other macronutrients and its split applications is critical. Obonyo et al. (2008) discovered that manipulating agronomical procedures such as genotype selection and fertiliser administration reduced the prevalence of A. soccata and boosted sorghum grain production. Rashid et al. (2008) conducted a field research in sorghum cultivation to find the best nitrogen quantity and application strategy. The grain yield rose from 2.92 to 5.61 t/ha in plots treated with 90 kg N/ha compared to the control using four doses of nitrogen (0, 60, 90, and 120 kg/ha) and two distinct administration techniques (soil application and foliar spray). The soil preparation technique was shown to be better than the foliar spray (4.56 t/ha.) method, with an average grain yield of 4.79 t/ha. Sarao and Mahal (2008) investigated the impact of various nitrogen levels (225, 275, 325, and 375 kg urea/ha) on the occurrence of rice insects. The mean revealed that greater levels of N resulted in considerably higher levels of leaf folder infestation (10.88%), dead heart (4.73%), white ear (4.98%), and plant hopper population (375 kg urea ha-1). Grain yield was comparable in rice supplemented with 225, 275, and 325 kg urea ha-1 (70.18-74.60 q ha-1).

Karikari et al. (2013) examined the effect of different fertiliser rates of inorganic fertiliser on pests using three fertiliser rates: higher rate (250 kg NPK+250 kg SA ha-1), recommended rate (250 kg NPK+125 kg SA ha-1) and no fertiliser (as control). The effects of the three fertiliser rates on the incidence of the various insects found (stem borers, leaf miners, head bugs, midges, and others) were significantly different. However, when it came to a specific bug species, the fertiliser rates had no discernible variations in their impacts. The Kapaala and Dorado cultivars were more heavily plagued with midges and head bugs than the Kadaga species. Randhawa and Aulakh (2013) limited the incidence to various cultivars and nitrogen levels. The basmati variety Punjab Bas-2 has the highest prevalence of rice leaf folder Cnaphalocrocis medinalis and stem borer Sripophaga incertulas insect pests. An increase in nitrogen level increases the frequency of leaf folder and stem borer.

Randhawa and Aulakh (2014) investigated the impact of N levels (0, 20, 40, and 60 kg ha-1) and basmati rice cultivars on the incidence of leaf folder and stem borer on the incidence of leaf folder and stem borer. When compared to other levels, the infestation was much greater at 40 and 60 kg N ha-1. Raipuria (2014) the lowest incidence of stem borer (dead hearts and stem tunneling) has been recorded in N_1, 50% at sowing + 50% at 30 DAS (41.15 and 4.70%) followed by N_5, 25% at sowing + 45% at 30 DAS+5% FS at 45 DAS+15% BLS + 10%GFS (43.05 and 5.13 %) respectively, however N_3, 25% at sowing + 50% at 30 DAS + 25% at BLS) was found to be maximum (51.42 and 5.95%).

To investigate the effects of nitrogen (N) fertilisation on insect infestation and damage to two types, Kapaala and Kundabua, at Yinduri in Ghana's Sudan Savanna zone. Both kinds supported similar levels of shootfly (Atherigona soccata) attack (dead hearts), but N treatment enhanced Dead Heart prevalence in a dose-dependent manner, with Kapaala showing a larger rise. Kundabua had a smaller mrid bug (Eurystylus oldi) population than Kapaala, resulting in reduced grain quality loss (viability, grain mass). As was the case with shootfly, applying N to the crop enhanced head bug infestation and damage. The yield of Kapaala was much greater. Kapaala grain yield increased from 1.08 t/ha at 0 N to 1.48 t/ha at 100 N, whereas Kundabua grain yield climbed from 0.95 t to 1.16 tons/ha. These findings support the enhanced variety's better production potential as well as its increased vulnerability to head bugs, the most common panicle pest of Sorghum in Ghana presently. The relevance of nitrogen fertilisers in increasing Sorghum output was also proven, with the caveat that treatment rates should be kept below 50 kg to avoid insect pest problems and preserve or improve grain quality Tanzubil (2014).

At RARS, Lam, Guntur, an experiment was conducted to determine the effect of various nitrogen dosages (0, 120, 150, 180, 225, 280, 350, 440 kg ha-1) on sucking pests and yield in the Jaadu BG-II cotton hybrid under protected and unprotected settings. Under both unprotected (1967 kg ha-1) and protected (2272 kg ha-1) circumstances, plots treated with 150 kg N ha-1 had the maximum seed cotton production. Following that, elevated nitrogen levels resulted in a drop in yield, according to Anusa et al (2017). Biradar and Sajjan (2018) reported shoot fly damage can be influenced by factors that affect plant growth. The application of balanced fertilizer can help in reducing shoot fly occurrence. Occurrence of shoot fly on sorghum cultivar CPV-86 decreased with the application of nitrogen, while in another cultivar CSH-8R, the incidence increased upto 60kg N/ha but declined at 90 kg/ha.

The impact of nitrogen and potash levels on the incidence of the early shoot borer, Chilo infuscatellus Snellen, in sugarcane varieties was studied at the Regional Research Station CCSHAU Uchani farm in Karnal, and it was discovered that when nitrogen was applied, the maximum mean percent incidence (7.12, 11.19, and 6.48, respectively) of early shoot borer was recorded at 250 kg N/ha in April, May, and June 2015, and the minimum (5.68, According to Singh et al., the administration of potassium with an optimal quantity of nitrogenous fertiliser, as well as the selection of a suitable variety, served as preventive measures against shoot borer infestation (2019). The effects of plant spacing and nitrogenous fertiliser on the occurrences and density of spotted and African pink stem borers were studied in a field experiment by January et al. (2020). The treatments comprised four amounts of urea fertiliser (0, 40, 80, and 160 kg N ha-1) and four levels of spacing (10cm10cm, 15cm15cm, 20cm20cm, and 25cm25cm). Nitrogen increased dead hearts by 4.8 percent, white heads by 2.8 percent, and stem borer larvae density from 0 to 5.6 larvae/m2, according to the findings.

Conclusion

From the above discussion, we can conclude that the Crop production can be sustained when breeders do not only focus on yield, but also on other measurable traits such as insect and disease resistance Sorghum is a highly valued commodity grown all throughout the world, with grain and stover valued equally in certain poor nations. Even in harsh weather circumstances, it may generate significant yields; nevertheless, insect pest damage at numerous phases of the plant's growth can impair output, affecting low-income farmers in developing nations. Sorghum insect pests include leaf-sucking insects, leaf-feeding insects, stalk or stem borers, panicle and stored grain pests. Modern control strategies include cultural controls, biological controls, pesticides (chemical, botanical, or microbial), and host plant resistance. An integrated strategy based on a mix of insect growth regulators and conservation initiatives is advised to protect natural enemies at the landscape level. In order to prevent the spread of new pests, effective management also necessitates regulatory standards.

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