THE NUTRITIONAL PERFORMANCE OF PLANTS AND THE EFFECT OF PLANT NUTRITION ON INSECT PESTS

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Abstract

Nutrients are the substances that an organism need for growth, tissue maintenance, reproduction and other activities as well as the substances that are necessary to maintain these functions. Insects need these nutrients for a variety of reasons, including growth, tissue maintenance, reproduction, and energy generation. They are able to satisfy their dietary requirements by consuming vegetation. Nitrogen has favourable effects on the performance of individual insects, which is most likely due to changes in host plant chemistry generated by nitrogen deposition. Increased nitrogen concentrations and a decrease in carbon-based defence chemical concentrations are two of the advantages of this strategy. When it comes to insects and other pests, potassium has a high degree of resistance. Potassium concentrations over a particular threshold are known to stimulate secondary chemical metabolism, restrict carbohydrate accumulation, and prevent plant damage caused by insect pests, among other things. It also has the added impact of diminishing the host's compatibility for many insect pests, which is beneficial to the host. Using secondary macronutrients and micronutrients such as calcium, zinc, and sulphur to control pest populations may also help to decrease pest numbers in the field. A mineral element called silicon, the most prevalent mineral element on the globe, has been linked in the development of plant resistance against insect pest damage.

Keywords: Zinc, Insects, Sulphur, Tissue Upkeep, Reproduction,Potassium

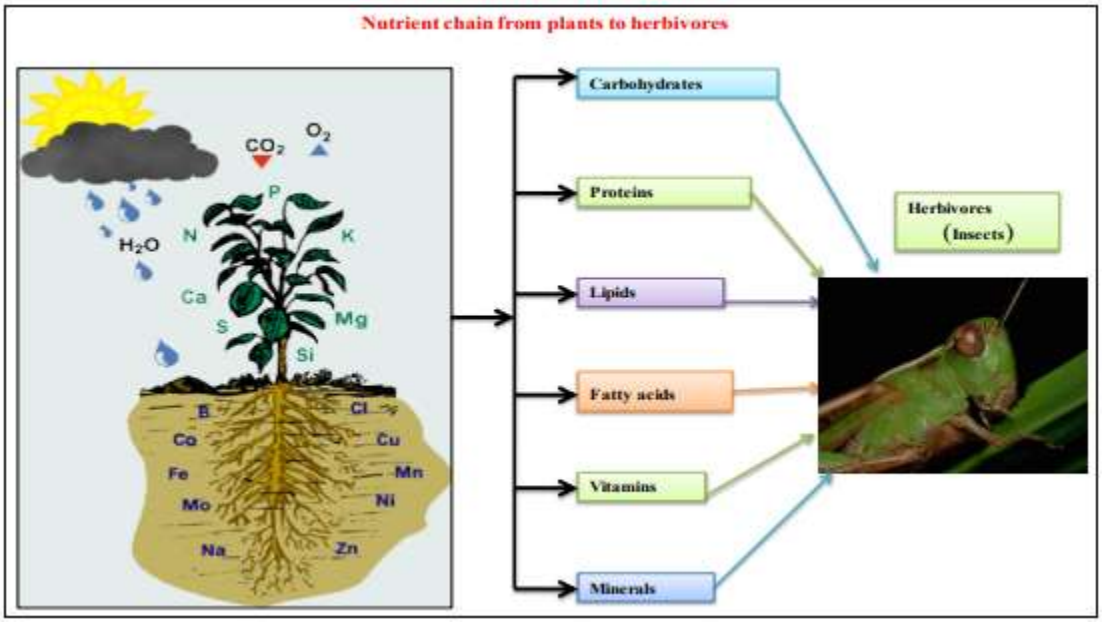
INTRODUCTION

Nutrition, according to a nutritionist, is defined as the nutrients that an organism need for growth, tissue repair and maintenance, reproduction, and the production of energy. Nutrition is essential for the survival of all living beings. Even though insects are capable of synthesizing some of

these compounds, the vast majority of them are obtained from food intake (Chapman 1998). As a result, the main and secondary chemical compositions of their host plants have a substantial impact on the survival, growth, and reproduction of phytophagous insects; as a result, food absorption and utilization are dependent on both plant quality and insect nutritional performance (Singh and Mullick 1997). A significant impact on the pace at which arthropods develop, their body composition, and their rate of development is exerted by the quality of the food they consume. In the early 1900s, Waring and Cobb published the first comprehensive study of the physiological and biochemical changes that occur in a plant, including nutritional and allelochemical alterations. In the presence of herbivores, these alterations have the potential to significantly alter the nutritional value of a plant. Because of this, an enormous amount of research has been done in the field of nutritional physiology, specifically in the investigation of the effects of nutritive compounds and secondary metabolites on insect responses, such as increased ingestive consumption of nutritionally deficient food or increased post ingestive activity of digestive enzymes, among other things (Duffy and Stout 1996; Lazarevic 2000). It is essential for the survival and reproduction of a vast number of lepidopterans, as well as other insect orders, that they have a healthy diet that is balanced (Genc 2006). The response of lepidopteran insects to a deficient diet includes a variety of behaviors such as raising or lowering the quantity of food they consume, changing from one food source to another, and/or adjusting the efficacy of the nutrients they take, among other things. According to their dietary needs, these animals require almost equal quantities of protein, amino acids, and carbohydrates (Nation 2001). HelicoverpaarmigeraHübner (Lepidoptera: Noctuidae), a polyphagous insect pest that attacks most plant structures in Iran and around the world, has been identified as an economically significant bean crop pest in Iran and around the world. HelicoverpaarmigeraHübner (Lepidoptera: Noctuidae) has been identified as an economically significant bean crop pest in Iran and around the world (including stems, leaves, flower heads, and fruits; Moral Garcia 2006). It preys on economically important bean crops in Iran as well as other countries of the world, including the United States of America (Reddy et al. 2004). However, even though H. armigera dies naturally at a rapid rate, it must be managed using chemical approaches to avoid substantial agricultural losses. H. armigera has received a great deal of attention recently because of environmental concerns as well as the development of pesticide resistance, particularly in the

case of pyrethroid pesticides (Gunning et al. 1984). Alternative control options for the invasive species H. armigera have been thoroughly researched. Survival, growth, weight, lifespan, and reproduction of animals are all negatively affected by plants that have antibiosis defenses in place to combat the bacteria that cause them to die. "Aphid control is a cost-effective, environmentally friendly strategy that has been successfully used in pest management techniques for a variety of insect pests, including aphids and aphid-like pests, on a wide range of plant species (Sarfraz et al. 2006)."

In addition to influencing the organism's survival, nutritional interactions with other chemicals in food have an impact on all areas of the organism's existence, including its growth, development, reproduction, health, and disease. When it comes to these processes, Insect Nutrition is the science that analyses the interaction of nutrients and other chemicals in food in connection to them, and it is a branch of biology that has been around for a long time. There is significance in each phase of the process, from ingestion to absorption to assimilation to biosynthesis to catabolism and excretion.



NUTRITIONAL REQUIREMENTS OF INSECTS

Carbohydrates	Dietary carbohydrates are primarily used as sources of energy, as well as for the production of fat and glycogen. Aspects of the eating behaviour and direction of some phytophagous insects on their host plants are influenced by sugars, which are the only source of nutrition for certain adult insects.
Proteins and amino acid	Enzymes, morphogenesis, and morphogenesis For example, tyrosine (Cuticularsclerotization), tryptophan, and others (visual screening pigment)
Lipids	Components of the cell wall include fatty acids, phospholipids, and sterols, among others. It is essential for reproduction to have enough levels of diacylglycerides, triacylglycerides, and polyunsaturated fatty acid derivatives. The phospholipids are composed of acetyl choline and phosphatidylcholines. Sterols are obtained by insects by feeding on plant tissue (cholesterol)
Vitamins	Vitamins that are water soluble, such as beta carotene, vitamin E, biotin, and folic acid, among others. Abortive ecdysis and death occur as a consequence of a lack of Vitamin C.
Minerals	Many insects, for example, use metals such as iron, zinc, and manganese to harden the cuticle of their mandibles.

Why does nitrogen increase the number of insects in the environment?

As a result of the excessive quantity of plant growth caused by high nitrogen fertilizer levels, spray coverage is reduced as a result of the reduced amount of plant growth created. Increased nitrogen fertilizer leads to the development of lush and green plants that, in turn, attract a large number of insects to their surrounding environment. "Plants that get nitrogen fertilizer exhibit an increase in dry weight, leaf area, leaf chlorophyll content, and grain yield, among other features. Nitrogen fertilizer also increases the yield of grain. When nitrogen levels rise, the biosynthesis or buildup of proteins, free amino acids, and carbohydrates rises, which may have been one of the factors that first brought insect populations to a particular location. Whiteflies, for example, are used to feed on okra, which is a food that is grown in the United States." According to the findings, the administration of just nitrogen or larger dosage of nitrogen increased the aphid population, but the use of phosphorus and potassium, with or without the addition of nitrogen, decreased the aphid population developing on the field. Even though the population was growing, the application of 120 kgha-1 nitrogen boosted the yield despite the growing population. "The nitrogen content of tomato plants was found to be directly related to the amount of nitrogen fertilizer applied by Jauset et al. (1998), and this was found to have an impact on the distribution of Trialeurodesvaporariorum adults among and within tomato plants in a study conducted on tomato plants. (Lycopersiconesculentum is the scientific name for a kind of tomato.) "Reduced nitrogen inputs to chrysanthemum plants result in increased production of chlorogenic acid, which is a compound that has antioxidant properties. Several phenylpropanoids, including chlorogenic acid and feruloylquinic acid, are discovered in greater amounts in the leaves of thrips-resistant chrysanthemums when the amount of nitrogen applied is reduced. The use of nitrogen fertilizers in the proper amounts may be effective in the management of insect herbivores that feed on plant roots, such as the cotton aphid. To maximize the effectiveness of nitrogen consumption while simultaneously reducing the environmental impact on the environment, the most efficient nitrogen fertilizer regime for irrigated paddy fields is presented. It was observed in field testing conducted over two years that the interaction of nitrogen and potassium fertilizers had a significant influence on the density of aphid populations in cotton plants. A significant difference exists between the nitrogen and phosphorus content of phytophagous insects and that of their host plants, resulting in an elemental mismatch that

severely limits the capacity of plants to achieve their nutritional needs (Huberty and Robert 2006). The use of phosphorus in conjunction with or without the addition of nitrogen in the treatment of mustard weed was shown to be effective in suppressing aphid population increase. A considerable drop in the total population was seen as the rate of application increased. Lower application rates resulted in considerably lower grain yields, while higher application rates resulted in significantly greater grain yields, showing that higher rates of treatment were more effective. "Brown planthopper population growth was greatly increased as a result of the application of a large amount of phosphorus to the field. As the pace at which the software was being built rose, the number of difficulties fell significantly, and the program was eventually completed. An increase in the quantity of Phosphorus present in the foliar tissues of plants leads to a significant rise in the plant's proclivity for enhanced population multiplication." The number of adults (females) is rising as a result of the luxuriant growth of the plant as a result of the administration of phosphorus to it. In terms of aphid performance, the element phosphorus had a substantial influence on a wide range of factors tested, including aphid density.

EFFECT OF PHOSPHORUS ON DIFFERENT INSECTS

Host	Herbivore species	Factor	Response
Mustard	Lipaphiserysimi	Population	Decrease
Busy Lizzy	Frankliniellaoccidentalis	Population (Female Adults)	Increase
Cotton	Empoasca sp.	Population	Increase
Cowpea	Clavigralla sp.	Population	Decrease

Potato Plants' suitability as a host for "various insect pests is reduced as a result of phosphorus altering secondary metabolic products such as phenolics and terpenes, and the accumulation of phenolics (tannin, lignin) serves as a barrier with deterring (antifeedent) or directly toxic (insecticidal) effects on herbivores." Management through Phosphorus (Facknath and Lalljee 2005). When tested on laboratory animals, phenolics have been proven to interfere with digestion, hamper development, decrease enzyme activity, and limit cell proliferation, among

other things. "Terrenes such as monoterpenes, sesquiterpenes, and terpene polymers interfere with neuronal transmission and phosphorylation in insects and other animals, as well as blocking the passage of food through their digestive systems. When insects were administered an excessive quantity of dietary P, the growth and survival of certain insects were hampered (1 percent). For example, Schistocerca Americana is a kind of spider."

Influence of potassium on different aphids sp.

Host plant	Herbivore species	Factor	Response
Mustard	Mustard aphid (Lipaphiseryisimi)	Population	Decrease
Pea	Pea aphid (Acyrthosiphonpisum)	Number of nymphs/plant	Decrease
Wheat	Green bug (Schizaphisgraminum)	Population	Decrease
Canola	Green peach aphid (Myzuspersicae)	Population	Decrease

Management through secondary macronutrients and micronutrients

It is possible to generate antibiosis effects such as toxic metabolites (alkaloids, glucosides) and induction of appropriate quantities of critical nutrients by a mix of techniques. Among other things, the presence of zinc and iron in rice has been shown to have an antibiosis impact on the Brown plant hopper. Increases in the zinc and sulphur content of soil resulted in a decrease in the quantity of brown plant hoppers in the soil. When utilised as a variable component of integrated pest management, silicon treatment in crops may be used to control a wide range of insect pests and disease outbreaks in crops. Because silicon treatment does not leave any pesticide residue in food or the environment, it may be simply used with other pest control practises to achieve maximum effectiveness. "It was found by Almeida et al. (2009) that increasing the amount of calcium silicate sprays applied to tomato plants resulted in a reduction in the number of thrips in tomato plants as a consequence of their mortality as nymphs. Silica reduced both borer survival

and the fraction of stalk length drilled that was completed by drilling (Keeping et al 2012)." Higher frequency of silica gel exposure resulted in increased mortality of larvae, according to Ma and Takahashi (2002), who also discovered a considerable concentration of silicon in the rice stems after increasing the frequency of exposure.

CONCLUSION

However, in contrast to human nutrition, where the impact of nutrition on "health" has received a great deal of attention, the use of "good" nutrition to promote plant resistance and tolerance has not yet reached its maximum potential. When it comes to increasing yields and establishing a sustainable agricultural system, the availability of fertilizers and adequate crop protection against herbivores are the most important concerns in current agriculture to address. In response to changes in the nutritional state of their hosts, herbivores become more sensitive. Increasing nutrient enrichment from agricultural and atmospheric sources has the potential to impact plant-insect interactions by affecting plant growth and defense systems. "To secure the long-term profitability of intensive farming, it will be important to optimize the management of chemical fertilizers. To make full use of integrated agricultural production in the future, it will be necessary to have a better understanding of the relationships between soil properties, fertilization procedures, plant nutrient content, and the potential for pests to impair crop yield or quality." The increased desire for more nutritious meals has prompted researchers to develop ways that would increase plant resistance to phytophagous insects in response to this need.

Plant resistance to a wide range of insect pests has been observed to be affected by the indirect effects of fertilization procedures, which operate through changes in the nutritional content of the crop. On the other hand, it has been observed that fertilization procedures can have an impact on plant resistance to a wide range of insect pests. Using inorganic fertilizers in excess and/or incorrectly may produce nutritional imbalances in plants as well as a decline in their capacity to withstand pests and diseases (Rashid et al. 2002). When soil amendments such as poultry manure and inorganic fertilizers are used to restore or increase fertility, pest control measures such as the use of chemical insecticides and other pest management options should be implemented to mitigate the effects of insect pest's infestations on crop productivity, according to the research findings. A dramatic change in the global nutrient cycle has occurred as a result of rising

amounts of easily accessible nutrients, having ramifications for both terrestrial and aquatic ecosystems (Aber et al. 2003).

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