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INFLUENCE OF NUTRIENT MANAGEMENT PRACTICES FOR MINIMIZING WHITEFLY (*Bemisia tabaci* Genn.) POPULATION IN TOMATO (*Lycopersicon esculentum* Mill.)

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Abstract: Whitefly is emerging one of the serious pests for tomato cultivation and farmers are indiscriminately using high dose of hazardous chemicals to minimize pest damage that ultimately affecting the soil, ground water, environment and consumers health. The aim of the present study was to develop best possible nutrient schedule of tomato cultivation by making the crop less preferred by the pest and thereby less susceptible to pest attack. Field experiment was conducted during 2005-06 and 2006-07 at UBKV, Pundibari, Coochcbehar, West Bengal, India. Fourteen different treatment combinations comprising two organic manures (Farmyard manure and vermicompost), inorganic fertilizers, *Azotobacter* and PSB containing biofertilizer (*Azophos*) in different levels were laid out in RBD with three replications. The infestation was recorded at 30 and 45 days after planting after enumerating number of flies per plant basis. The results showed that different sources of nutrient have significant effect on reducing the whitefly population and the treatments containing higher amount of FYM or vermicompost showed better result over sole inorganic fertilizers. However higher amount of vermicompost emerged superior in minimizing the whitefly population compared to farmyard manure. Considering the magnitude of whitefly attack and economic yield, the treatment comprising of 75% RDF of inorganic fertilizers and vermicompost (4 t ha^{-1}) inoculated with *Azophos* biofertilizer may be practiced for sustainable tomato cultivation.
Key words: Tomato whitefly, Inorganic fertilizers and Organic nutrients.

INTRODUCTION

Tomato is one of the major vegetables grown extensively throughout the world. Leaf curl virus (LCV) disease constitutes one of the key challenges for present day tomato production. Whitefly has the ability to acquire and transmit the leaf curl virus from one infected to other healthy plant especially due to their transient feeding behaviour. It injects toxicogenic substances present in saliva that can induce physiological changes in plant lead to typically stunted and crinkled plant growth having very small fruits or no fruits that drastically reduces

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the fruit yield. Farmers are indiscriminately using hazardous pesticides to control the pest, which ultimately affecting soil, ground water, environment and consumers health. The potential of organic amendments in suppression of insect pest population over synthetic inorganic fertilizer has long been recognized. Evidence of suppression of insect attack by various forms of organic amendments has been reported by different researchers (Ramesh, 2000; Rao *et al*., 2001; Biradar *et al*., 1998; Patriquin *et al*., 1995; Culliney and Pimentel 1986; Yardim and Edwards, 1998; Huelsman *et al*., 2000). Organic amendments provides more balanced and better timed source of nutrition for plant growth through the gradual decomposition of the organic matter by microorganisms and slower mineralization and release of nutrients that it contains (Pascual *et al*., 1997; Zink and Allen, 1998; Patriquin *et al*., 1995). The amount, timing and types of inorganic or organic fertilizer application can either stimulate or suppress pest population, depending upon the pest species and the crop concerned. Excess fertilization, especially with nitrogen, can often promote succulent and excessive vegetative growth that may increase the multiplication rate of pests and pest damage. Knowledge of the form of a plant's nutrition, combined with the dynamics and ecology of a pest can often provide an excellent basis for successful pest management (El-zik and Frisbie, 1991). Vermicompost, a organic manure obtained in the form of casting of ingested biomass by earthworm after undergoing physical, chemical and microbial transformations. Besides macro and micronutrients it also contains humic acids ,plant growth promoting substances like auxins, gibberellins, and cytokinins (Krishnamoorthy and Vajrabhiah, 1986), N-fixing and P-solubilizing bacteria, enzymes and vitamins (Ismail, 1997). The water soluble components of vermicompost such as humic acid, growth regulators, vitamins, micronutrients and beneficial microorganism increases the availability of plant nutrients, results in increased growth, higher yield and better quality produce (Atiyeh *et al*., 2002). In addition to vermicompost, farmyard manure and biofertilizers also play vital role as organic nutrient sources for sustainable soil health and crop growth (Mali *et al*., 2005). The present work was designed to study the comparative performance of organic and inorganic sources of nutrients on incidence of whitefly in tomato and to identify the best suited eco friendly nutrient management practice for sustainable tomato production and suppression of white fly.

MATERIALS AND METHODS

The field experiment was conducted at the experimental field of UBKV, Pundibari, CoochBehar, West Bengal ($89^{o}23'53''$ E longitude and $26^{o}19'86''$ N latitude) during winter

season (November to March) of 2005-2006 and 2006-2007. The soil was well drained sandy loam having pH of 5.74, organic carbon content 0.85% and available N, P_2O_5, K_2O, were 155.85 kg ha^{-1}, 20.23 kg ha^{-1} and 125.90 kg ha^{-1} respectively. The treatment consisted of 14 combinations of different nutrient sources and was laid out in randomized block design with three replications. The treatments were selected for sole and combined application of varied levels of vermicompost and farmyard manure (FYM) along with 100% and 75% of recommended dose of inorganic fertilizers in presence and absence of biofertilizer. The combinations were T_1-100% Recommended dose of fertilizer (RDF) (100:60:60 kg N P K ha^{-1}) ; T_2-100% RDF + 6 tonnes FYM ha^{-1} + biofertilizer; T_3-100% RDF + 2 tonnes vermicompost ha^{-1} + biofertilizer ; T_4-100% RDF + 3 tonnes FYM ha^{-1} + 1 ton vermicompost ha^{-1} + biofertilizer ; T_5 -75% RDF + 6 tonnes FYM ha^{-1} ; T_6 -75% RDF + 6 tonnes FYM ha^{-1} + biofertilizer ; T_7 -75% RDF + 2 tonnes vermicompost ha^{-1} ; T_8 -75% RDF + 2 tonnes vermicompost ha^{-1} + biofertilizer ; T_9 -75% RDF + 3 tonnes FYM ha^{-1} + 1ton vermicompost ha^{-1} + biofertilizer ; T_{10} - 75% RDF + 12 tonnes FYM ha^{-1} ; T_{11}-75% RDF +12 tonnes FYM ha^{-1} + biofertilizer ; T_{12}-75% RDF + 4 tonnes vermicompost ha^{-1} ; T_{13}-75% RDF + 4 tonnes vermicompost ha^{-1} + biofertilizer and T_{14} -75% RDF + 6 tonnes FYM ha^{-1} + 2 tonnes vermicompost ha^{-1} + biofertilizer. Tomato seedlings (cv. Pusa Ruby) were transplanted in 3.75 m × 3.75 m plots with a spacing of 75 cm within and between rows. Vermicompost and farmyard manure were applied to the respective plots at the time of transplanting. *Azophos*, *Azotobacter* and phosphate solubilizing bacteria containing biofertilizer were applied as seedling dipping (250 g $litre^{-1}$ water) just before transplanting. Full dose of P_2O_5 and K_2O along with half N were applied as basal and rest N was top dressed at 30 days after transplanting. The crop was raised adopting standard cultural practices. To record the whitefly infestation five plants per plot were randomly selected and the number of whiteflies per leaf was counted on five leaves of each plant and average was worked out.The observation were recorded at 30 and 45 days after transplanting (DAT). The observations recorded were statistically analyzed using INDOSTAT statistical package.

RESULTS AND DISCUSSION

The observation recorded on number of whiteflies at 30 DAT and 45 DAT has been presented in the Table 1. Incidence of whitefly started at seedling stage and it continued throughout the vegetative growth phase of the crop. Significant population of the pest was observed during 30 DAT and 45 DAT during both the years of study. The population varied significantly with the differences in source of nutrition. At 30 DAT the whitefly infestation

was higher over 45 DAT for all the treatment combination. Maximum incidence of whitefly was recorded among the treatments containing 100% inorganic fertilizer treatment combination (T_1 to T_4) as compared to the treatments having 75% inorganic fertilizers treatment combination (T_5 to T_{14}). Among the inorganic fertilizers treatment combination the highest population (2.86 leaf^{-1}) was recorded for the treatment containing 100% sole inorganic fertilizer (T_1) however T_4 was found more effective over T_1 in reducing the incidence of white fly under field condition. Tomato plants grown in the growth media having 75% inorganic fertilizer along with higher amount of organic manures (T_{10} to T_{14}) significantly reduced the incidence of white fly and it was lowest (0.91 leaf^{-1}) for the treatment containing 75% RDF of inorganic fertilizers and vermicompost (4 t ha^{-1}) inoculated with biofertilizer (T_{13}). At 45 DAT, the whitefly population was reduced for all the treatments over 30 DAT, however higher population was again recorded among the 100% inorganic fertilizers treatment combination (T_1 to T_4). Among the 75% inorganic fertilizers treatment combination, treatments containing higher amount of organic manures (T_{10} to T_{14}) significantly reduced the incidence of white fly. The treatment T_{13} was found consistently effective in reducing the incidence and recorded the lowest whitefly population (0.67 leaf^{-1}) and highest fruit yield (26.14 t ha^{-1}) of tomato. The treatments T_{14} and T_{12} were the next in order of effectiveness in reducing the population of white fly and sustainable fruit yield of tomato. The finding indicated that reduced levels of inorganic fertilizers and increasing levels of organic manures were highly effective in reducing the incidence of whitefly in tomato. The humic acid present in vermicompost usually provide plants with a balanced source of nutrients that can influence the composition and physiology of plants. Apart from that vermicompost might have provided some growth promoting substances, vitamins and enzymes which are not available in inorganic fertilizers, and these probably have increased the plant resistance to pests or made the plants less palatable to the pest.The study corroborated the findings of Godase and Patel (2002) in brinjal who reported that incidence of whitefly was significantly higher at higher level of nitrogenous fertilizer compared to organic manures amended plots. Panda *et al.,*(2005) reviewed the pest suppressing ability of vermicompost and found that vermicompost based treatments harboured lowest population of sucking pest namely jassids and thrips in chilli. The mechanisms for decreasing pest attacks may be due to differential availability of mineral nutrients in plants (Patriquin *et al*. 1995). Prestidge and McNeill (1983) found that plants grown with high levels of nitrogen fertilizer resulted in larger infestation of pest. They stated that amount of nitrogen in a plant can often

be correlated positively with the extent of insect feeding and the products of nitrogen metabolism, such as amino acids have also been linked to increased insect pest attacks on plants as large amounts of amino acids stimulated the growth and fecundity of some herbivorous insects. Integration of different source of nutrients gradually released essential plant nutrients throughout the growth period that might have enhanced the induced resistance development and subsequently helped in escaping whitefly infestation in tomato. Ravi *et al*.,(2006) also recorded reduced incidence of sucking pest namely whitefly and leaf hopper under organic manures (FYM and vermicompost) and biofertilizer treated plots and concluded that organic amendments comparatively increased the total phenols in the plants and also the activity of the enzymes like polyphenol oxidase and peroxidase, which might be responsible for the reduced pest incidence.

CONCLUSION

The present study revealed that to reduce the pesticide load on soil and ground water and ultimately on environment curtailment of chemical fertilizers through judicious application of inorganic and organic sources of nutrients preferably vermicompost and biofertilizer should be considered in the nutrient schedule of tomato cultivation. The treatment comprising of 75% RDF of inorganic fertilizers and vermicompost (4 t ha^{-1}) inoculated with *Azophos* biofertilizer may be practiced to minimize white fly population and sustainable tomato cultivation. In addition to saving of 25% doses of chemical fertilizers, it will also improve the fertilizer use efficiency and subsequently will help in sustaining the fertility and productivity of soil.

Table 1. Effect of different nutrient sources on white fly incidence of tomato (pooled mean of 2 years)

Treatments	Number of white flies $leaf^{-1}$		Fruit yield (t ha^{-1})
	30 DAT	45 DAT	
T_1-100% RDF (100 : 60 : 60 kg N P K ha^{-1})	2.86	2.67	15.42
T_2-100% RDF + 6 t ha^{-1} FYM + biofertilizer	2.38	2.24	21.67
T_3-100% RDF + 2 t ha^{-1} VC + biofertilizer	2.12	1.97	22.20
T_4-100% NPK + 3 t ha^{-1} FYM + 1 t ha^{-1} VC + biofertilizer	1.89	1.71	21.89
T_5 -75% RDF + 6 t ha^{-1} FYM	1.76	1.64	19.68
T_6 -75% RDF + 6 t ha^{-1}FYM + biofertilizer	1.69	1.58	20.23

T_7 -75% RDF + 2 t ha^{-1} VC	1.67	1.61	20.89
T_8 -75% RDF + 2 t ha^{-1} VC + biofertilizer	1.56	1.53	21.48
T_9-75% RDF + 3 t ha^{-1} FYM+1 t ha^{-1}VC/ha+ biofertilizer	1.73	1.67	21.13
T_{10} -75% RDF + 12 t ha^{-1} FYM	1.59	1.51	22.76
T_{11}-75% RDF +12 t ha^{-1} FYM + biofertilizer	1.47	1.43	23.82
T_{12} -75% RDF + 4 t ha^{-1} VC	1.38	1.21	24.26
T_{13}-75% RDF + 4 t ha^{-1} VC + biofertilizer	0.91	0.67	26.14
T_{14}-75% RDF+ 6 t ha^{-1} FYM +2 t ha^{-1} VC + biofertilizer	1.17	1.09	24.83
S.Em (±)	0.11	0.09	0.98
CD (P=0.05)	0.31	0.25	2.77

R.D.F.-Recommended dose of fertilizer; FYM: Farmyard manure; VC-Vermicompost; S. Em-Standard error of the mean; CD-Critical difference

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