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International Journal of Current Research
Vol. 5, Issue, 09, pp.2625-2627, September, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

AN EXPLORATORY STUDY ON USING RURAL POULTRY AS A SOURCE OF BIO-CONTROL AGENT FOR PLANTATION AND SOME VEGETABLES

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ARTICLE INFO

Article History:
Received 24th June, 2013
Received in revised form
10th July, 2013
Accepted 07th August, 2013
Published online 14th September, 2013

Key words:

Bio-control,
Ecosystem,
Exploratory study,
Industrialization,
Nutrients, pesticide,
Plantation,
Rural poultry,
Urbanization,
Vegetables.

ABSTRACT

The continuous explosion in human population growth is putting pressure on agriculture land. Though use of pesticides covers wide range of plants, the main concern to human health is fruits and vegetables which are eaten raw. Many of the pesticides have genocidal effect too. Many of the natural bio-control agents disappeared due to changes in the ecosystem. Situation will worsen in future due to damage to the ecosystem. In the present exploratory study, while improving the production and productivity of vegetables and fruit crops, rural poultry was evaluated as bio-control agents. The present study has been conducted in 65 villages of Barabanki and Raebareli districts of Uttar Pradesh, India under the World Bank funded NAIP of ICAR during 2009-2012. The aim of the project was to create sustainable livelihood security through novel low input-highly profitable technological interventions in an integrated manner. Guava seedlings were transplanted at 3x3m spacing and integrated with rural poultry. Integration of banana plantation with rural poultry was made on the same line. The chicks were integrated with brinjal, ladies finger, capsicum and tomato on the same line. No pesticides were used in any of the integration. The banana plantation field developed thick canopy by 7th-8th month beyond which rearing of birds was problematic. The guava plantations allowed the rearing of birds throughout the year and during 4 years of the observations. The minimum plantation area assessed for each grower bird was 5-6 sq.m which allowed all the cultural operations in the plantations. There was not a single plant affected with any insect/ pest. Leaves were green and normal. In contrast the non-integrated plantations had perforated leaves, attacks of pest and diseases (mild degree) and growth was slower. Erected vegetables integration showed contrast results. In integrated fields, the seedling mortality was less than 4% compared to 12-16% in non-integrated fields. Termite problem in integrated field could not be observed but was seen in the non-integrated fields. Integration of rural poultry with plantations and vegetables was done keeping in view 3 facts viz. providing biomass in form of microbe rich feces, utilization of interspaces increasing productivity per unit area and exploring the chances of reduction of pest population. Because of the exploratory nature the study however requires further investigations.

INTRODUCTION

The continuous explosion in human population growth is putting pressure on agriculture land. This scenario of urbanization, industrialization and enhancing production has severe impact on ecosystem (Dhama *et al.*, 2013a). The changing climate is also adversely affecting the ecosystem, though if it happens slowly in natural way, the alternate ecosystem continuously develops (Dhama *et al.*, 2013b). The natural habitat of many bio-control agents is destroyed. The situation is resulting into higher incidences of diseases and pests (Korat and Mehta, 1996). The over exploitation of soil nutrients without replenishment, is increasing the susceptibility of plants to diseases. To control the diseases and pests, use of chemical pesticides started and besides their indiscriminate use, sub-standard pesticides have posed serious concern (Jurewicz and Hanke, 2008). The term pesticides are a general-term and include range of compounds used as insecticides, fungicides, herbicides, rodenticides, nematicides, plant growth regulators etc. The introduction and use of chemical insecticides as organophosphate, carbamates, pyrethroids, and herbicides and fungicides from 1960s onward contributed greatly to pest control and agricultural production. In India pesticides production started in 1952 with BHC near Kolkata (Mathur, 1999) and production from 5000 tons in 1958 has crossed 102240 tons in 1998 it self (Saiyed *et al.*, 1999). More pesticides in India is usually used by farmers who are economically sound having larger landholdings (Mukherjee *et al.*, 2006). Though use of pesticides covers wide range of plants, the main concern to human health is fruits and vegetables as these are eaten raw in order to obtain essential nutrients (Mahima *et al.*, 2013). The affected human population is not only the consumers, but also production workers, sprayers, bio-control agents and agricultural farm workers. Many of the systemic pesticides also have genocidal affect and inducing cancers through chromosomal abrasion and damage to DNA is a common report (Bassil *et al.*, 2007; http://www.epa.gov). It has been estimated that in the developing

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world 3 million workers experience severe pesticide poisoning in the agricultural sector out of whom about 18,000 die (Jeyaratnam, 1990; Miller, 2004). The use is increasing every year to have higher productivity per unit area (Fantke *et al.,* 2012). In the natural ecosystem, suitable bio-control agents also existed in the vicinity and thus, the deleterious impact of pests was within limit (Cory and Myers, 2000; Wright *et al.,* 2005). Due to damage to the ecosystem, many of these natural bio-control agents disappeared and situation will worsen in future (Gilden *et al.,* 2010). In the present exploratory study, while improving the production and productivity of vegetables and fruit crops, rural poultry was evaluated as bio-control agents.

MATERIALS AND METHODS

The present study has been conducted in 65 villages of Barabanki and Raebareli districts of U.P., India under the World Bank funded NAIP of ICAR during 2009-2012. The aim of the project was to create sustainable livelihood security through novel low input-highly profitable technological interventions in integrated manner. The area represent typical ecosystem of northern plains of India. Various technological interventions viz. new rural poultry production, dairy, goat, pig, vegetables (seasonal as well as off season), cash crops (banana, guava, gladiolus), fruit crops (guava, mango), improved composting for soil health improvement (vermi-composting, NADEP), and consortia of microbes as plant growth enhancers (CSR-BIO) were used under integrated farming system/ specialized integrated farming system approach to enhance per unit productivity and higher profitability.

- **Guava-rural poultry integration:** Guava seedlings (Sweta, lalit varieties) were transplanted at 3x3m spacing. The area of plantation varied from family to family as per the availability of less fertile land. The minimum size of plots was 300 sq.m while with small farmers; it was more than 0.24 ha. Landless or sub-marginal families had smaller areas and it was intercropped with vegetables and on one side had small shelter of 4x4x8 feet (WxHxL) dimension for the chicks. The chicks were allowed to graze in the plantation and assessment of number of grower birds suitable per 100 sq.m plantation was assessed in the scenario, depending on the availability of moving insects etc. Azolla *in situ* cultivation was also practiced either in the plantation area or on the side of the plot. Birds also fed on the fallen fruits of guava.
- **Banana-rural poultry integration:** on the same line, integration of banana plantation with rural poultry was made.
- **Vegetables-rural poultry integration**: The chicks were integrated with brinjal, bhindi (ladies finger), capsicum and tomato on the same line. The chicks were allowed by the farmers to graze after the seedlings attained the height of around one foot.
- No pesticides in any of the integration were used. In the same locality in the village, at least 4-5 plots of each type viz. guava, banana, and vegetables were left without integration as the farmers either had other approachable space for poultry or were not interested for poultry rearing. Cultural practices were same for all the respective groups and plants growth enhancer (CSR-Bio), developed by us, was used for basal and seedling treatment and later as foliar spray.

RESULTS

The banana plantation field developed thick canopy by 7^{th}-8^{th} month and beyond that rearing of birds was problematic. It was irrigated at interval of 10-15 days during summer month and this wet soil was not suitable for poultry. The chicks and growers relished on insects in the field and all the plants were healthy with robust growth rate. In contrast, the non-integrated field had moderately healthy plants but visible growth rate was different along with size and green coloration of leaves when compared to integrated fields. The guava plantations allowed the rearing of birds throughout the year during 4 years of the observations. The minimum plantation area assessed for each grower bird was 5-6 sq.m which allowed all the cultural operations in the plantations. There was not a single plant affected with any insect or pest, leaves were green and normal. In contrast the non-integrated plantations had perforated leaves, attacks of pest and diseases (mild degree) and growth was slower. After 2 years, when the bearing in the plants (both seasons) was full, birds enjoyed the fallen damaged fruits and it supplemented the energy, vitamins and minerals to the birds. Erected vegetables (brinjal, capsicum, bhindi and tomato) integration showed contrast results. In integrated fields, the seedling mortality was less than 4% compared to 12-16% in non-integrated fields. The termite problem in integrated field could not be observed where as it was seen in the non-integrated fields. The plants were healthy, had no disease or pest problem where as mild attack of pest born diseases were seen in some of the non-integrated field.

DISCUSSION

The extensive use of pesticides, particularly systemic, is a wide spread phenomenon in crop production (Rao *et al.,* 2007). The impact on avoiding pest and diseases in vegetable crops is significant as it uses more pesticides than other crops but it may prove deleterious to human health (Zehnder *et al.,* 2007). The use of sub-standard or adulterated pesticides and their indiscriminate uses are very common. The recommended withdrawal period before harvesting the vegetables or fruits is not followed, probably due to unawareness or fear of loss in harvest (Lewis *et al.,* 1997; Martin *et al.,* 2013). The natural bio-control agents are either absent or negligible in population (Collier and Steenwyka, 2003). Integrated system of poultry rearing is always beneficial to the farmers as there is possibility of reduction of input cost in subsequent years of initiation (Rai *et al.,* 2013a, Rai *et al.,* 2013b). Integration of rural poultry with plantations and vegetables was done keeping in view 3 facts viz. providing biomass in form of microbe rich feces, utilization of interspaces to increase productivity per unit area and exploring whether it can reduce the insect/pest population (Cook, 1993; Chang and Juma, 1996; Moore *et al.,* 2000). Many of the insects act as career for viruses and if they are destroyed, the transmission rate is severely affected (II'inykh *et al.,* 1995). One bird in its entire productive period of 72 weeks produces more than 50 kg fecal biomass which means more than 50 tonnes from 1000 birds. It is rich in nitrogen contents also as per the observation of earler workers (Nannipieri *et al.,* 1990; Stern, 1993). Thus, additions of extra-biomass may not be needed and soil health improvement will naturally occur (Logah *et al.,* 2010).

The feeding of birds on termites, ants, insects etc. helped the plants to grow un-interrupted and diseases were not observed (Aini, 1990; Huque and Hossain, 1991). It is however required to supplement the poultry diet with either or both calcium as well as essential amino acids in order to meet the complete dietary requirement of the birds which has been done through azolla *in situ* cultivation (Tadelle and Ogle, 2002; Khusro *et al.,* 2012; Rai *et al.,* 2012). In our earlier studies in A&N islands to improve the productivity of homesteads, similar observations were made. Since homesteads are way of life in coastal and island eco-systems and any improvement in it, directly increases the economic return to the families. Poultry, while working as value added component in the system, significantly reduced the pest problems (Pandey *et al.,* 2006, 2007a,b). Since it is exploratory work, it needs further systemic investigation. There is common fear among the horticulturists that birds will damage the plants. In the present study, not a single plant damage was recorded, instead they were healthier. In banana, integration can be implemented only for initial 7-8 months and then at the time of ripening/maturing so that dampness is not affecting the birds (Fuller *et al.,* 2004; Gallai *et al.,* 2009; www.chinaccm.com).

Conclusion

Integrated approach for rural poultry management along with plantation and vegetation increases the economic return by reducing

the cost of additional biomass, increasing productivity and reducing insects/ pests. Because of the exploratory nature the study however requires further extensive investigations.

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