Effect of aphids and whiteflies infestation on potato yield in Up Country Wet zone of Sri Lanka

H.A.S.N. Hettiarachchi, M.M. Kumarage and K.M.C.R.K. Bandara

Agriculture Research Station, Sita Eliya, Nuwara Eliya, Sri Lanka

Introduction

Potato (*Solanum tuberrosum* L.) is one of the most important and extensively grown crops in Nuwara Eliya and Badulla districts of Sri Lanka. High cost of production is identified as one of the major constrains in the potato value chain. Avoiding use of unnecessary insecticides is therefore, identified as a key strategy in reduction of cost of production. Aphids and whiteflies act as minor pests of potato particularly in Nuwara Eliya region. According to a survey conducted within the Agriculture Instructor range in Nuwara Eliya during 2017, it was revealed that 66% of potato growing farmers rely heavily on insecticides in controlling aphids and whiteflies (Seasonal Report, 2017). In response to this, the efforts were made for evaluating the effect of use of insecticides to control aphids and whiteflies of potato under Up Country Wet zone climatic conditions.

Materials and methods

Field experiment was carried out at the Agriculture Research Station (ARS), Sita Eliya during *Maha* 2016/17, *Yala* 2017, *Maha* 2017/18 and *Yala* 2018. Uniformly sprouted potatos (variety - Granola) with 3-4 sprouts were planted in plots (6 m^2) at the spacing of 60 x 25 cm (contained 40 plants). Crop planting and maintenance were done according to recommended agronomic practices of Department of Agriculture (DOA), Sri Lanka. Three treatments were arranged in a Randomized Complete Block Design (RCBD) with four replicates. Treatments were (T_1) - Thocyclam hydrogen oxalate 50% SP and Imidacloprid 200 g/*l* SL sprayed at recommended dosages once a week alternatively (6 applications/ Season) and (T_2) - Thocyclam hydrogen oxalate 50% SP and Imidacloprid 200 g/*l* SL bi-week alternatively (3 applications/ Seasons) to manage aphids and whiteflies. (T_3) - untreated control. Application of insecticide was started at 5 Weeks After Planting (WAP) and continued up to 10 WAP. Number of aphids and whiteflies were recorded in weekly intervals throughout the season from 8 randomly selected plants and harvesting was carried out at the stage of physiological maturity i.e. 105 days after planting and total yield/plot was recorded. All plots were protected from diseases and other pests. Data were analyzed using analysis of variance (ANOVA) with SAS statistical package version 9.1 and mean separation was performed using Duncan Multiple Range Test at $p<0.05$.

***** Short Communication***

Results and discussion

Aphid and whitefly populations

Development of aphids and whiteflies population was observed from 5 to 12 weeks. In comparison to the *Yala* 2017, lower number of aphids and whiteflies were reported during *Maha* 2016/17, *Maha* 2017/18 and *Yala* 2018 in unprotected plots and this may be due to the variation in climatic factors within the four seasons (Figure 1). The rise of aphids and whiteflies populations could be attributed by the relative low rainfall and low relative humidity (RH) prevailed during *Yala* 2017 season (Figure 2, A and B). Kelm *et al*. (2009) also reported that weather was the factor, which mostly determines the population buildup of aphid number in potato crops. Also whitefly is one of the most economically important pests in warmer climatic condition and negative correlation was reported between whitefly population and weather parameters on potato (Jha and Kumar, 2018). According to the survey conducted by ARS, Sita Eliya during 2006/2007 period, potato fields in Nuwara Eliya were abandant with natural enemies of aphids. Alyokhin *et al*. (2011) and Mohd Rasdi *et al*. (2012) have found out that aphid and whitefly population reach low due to their natural enemies without chemical control interventions.

Table 1. Potato tuber yield of insecticide treated and untreated plots during *Maha* 2016/17, *Yala* 2016, *Maha* 2017/18 and *Yala* 2018

Treatments	Yield (t/ha)			
	Maha 2016/17	Yala 2017	Maha 2017/18	Yala 2018
Weekly interval insecticides application	33.7	37.1	27.1	40.2
Bi-weekly interval insecticides application	33.1	34.2	25.7	39.0
Untreated control	32.5	33.7	25.1	37.8
CV %	9.09	5.44	8.54	14.6
NS-not significant				

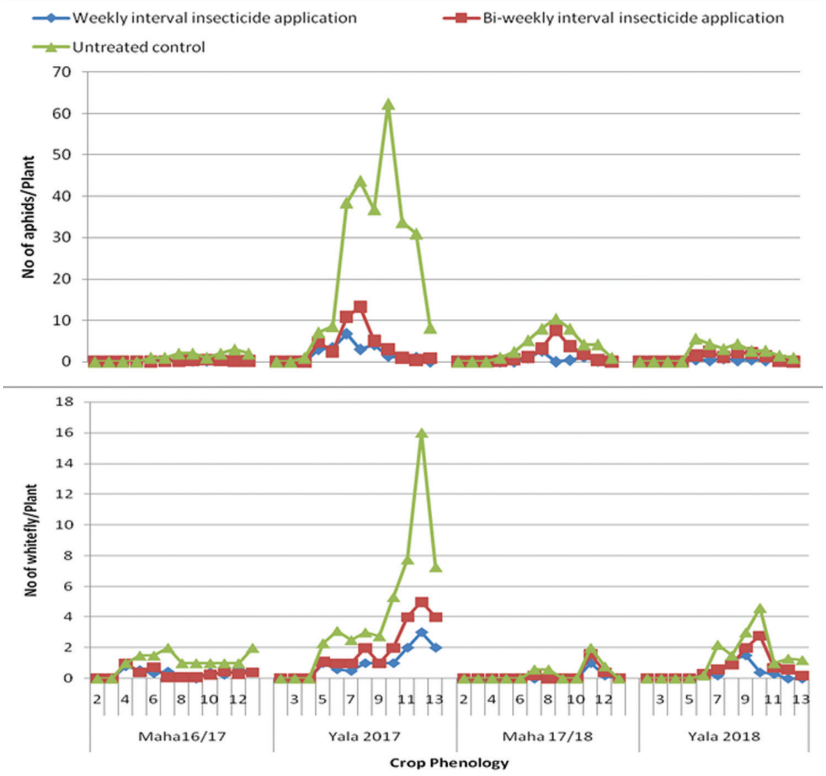

Figure 1. Aphids and whitefly population in insecticide treated and untreated plots during *Maha* 2016/17, *Yala* 2017, *Maha* 2017/18 and *Yala* 2018 (N=8 and 4 replicates)

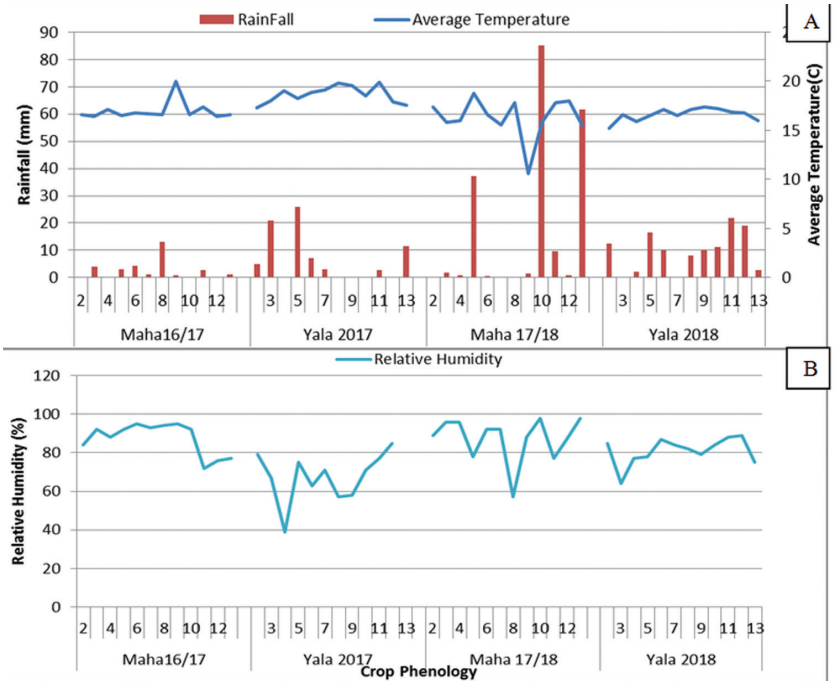

Figure 2. Average temperature, rainfall (A) and Relative humidity (B) in *Maha* 2016/17, *Yala* 2017, *Maha* 2017/18 and *Yala* 2018

Tuber yield

There was no significant difference observed between insecticide treated and untreated plots during the four seasons (Table 1). This is mainly due to the low pest population development and the absence of viral disease infestations during four seasons. Evans *et al*. (2000), Machangi *et al*. (2003) and Nasruddin and Mound (2016) have pointed out that potato tuber yield reduction is caused by heavy infestation of aphid, whitefly and viruses.

Conclusion

This study revealed no significant yield reduction in the plots treated for aphids and whiteflies weekly and bi-weekly compared to that of untreated under up country wet zone condition in Sri Lanka. Therefore, routine application of insecticides on potato for the control of the above pests is economically unproductive and insecticide application on aphids and whiteflies could be avoided.

References

Alyokhin, A., F. A. Drummond, G. Sewell and R. H. Storch. 2011. Differential effects of weather and natural enemies on coexisting aphid populations. Environ. Entomology 40: 570-580.

Evans A. 2000. Aphids and aphids borne virus diseases in potatoes. Technical note. The Scottish Agriculture College, Edinburgh.

Jha S. K. and M. Kumar. 2018. Fluctuation in whitefly *Bemisia tabaci* population in relation to environmental factors. Journal of Entomology and Zoology Studies 6: 3011-3014.

Kelm M., I. Fostiak and W. Kadlubiec. 2009. Factors determine the number of aphids/Hemiptera, Aphidoidea/ in conventional and organic potato crops, Aphids and other Hemipterous Insects 15: 85-105.

Machangi, J.M., F.M. Olubayo, J.H. Nderitu, R.W. Njeru, R. El-bedewy1 and E.O. Obudho. 2003. Effect of aphids and virus diseases on yield of seed potatoes in Kenya. African Crop Science Conference Proceedings 6: 220-223.

Mohd Rasdi, Z., M.R.C. Salman, A.A. Hassan, D. Hamady, A. Hamaseh and F. Ismail. 2012. Field Evaluation of Some Insecticides on Whitefly (*Trialeurodes vaporariorum*) and Predator (*Macrolophus caliginosus*) on Brinjal and Tomato Plants. Asian Journal of Agriculture and Rural Development. 2: 302-311.

Nasruddin, A. and L.A. Mound. 2016. First record of *Trialeurodes vaporariorum* Westwood (Hemiptera: Aleyrodidae) severely damaging field grown potato crops in South Sulawesi, Indonesia. Journal of plant protection research 56: 199-202.

Seasonal Report. *Maha* 2006/2007, *Yala* 2017. 2017. Agriculture Research Station, Sita Eliya, Department of Agriculture, Sri Lanka.