Tropical Agricultural Research and Extension, Vol. 1, No. 2: 154 -158, 1998

Present status of managing chilli leaf curl complex in the North Central Province of Sri Lanka

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Accepted 25 June 1998

ABSTRACT

A survey was conducted in the North Central Province (NCP) of Sri Lanka, during the South-West monsoon season (yala[2]) 1996, to study the crop management practices followed by farmers and the impact of such practices on leaf curl complex (LCC) in chilli (*Capsicum annum* L.). Late planting of chilli crop in May and June as reported by 79% of the farmers, lack of quality seeds of tolerant cultivars and application of excess amount of nitrogen fertilizer are the major contributory factors for the spread of LCC. Although 72% of the farmers complained thrips -*Scirtopthrips dorsalis* Hood as their major constraint, only 45% of the farmers surveyed have used recommended insecticides and many (55%) used excess amount of spray mixtures. However, the number of farmers applying insecticides at proper interval has increased to 95% after the demonstrations conducted in 1995. Since indiscriminate use of insecticides and N- fertilizer on late planted chilli crop has aggravated the thrips damage, an awareness programme should be carried out with special emphasis on integrated crop management to overcome this situation.

Key words: *Capsicum annum*, chilli leaf curl complex, integrated crop management, *Scirtothrips dorsalis*, thrips

INTRODUCTION

Chilli (*Capsicum annum* L.) is an important condiment grown in Sri Lanka. In addition to Mahaweli river basin, it is cultivated extensively in Anuradapura, Polonnaruwa, Monaragala and Hambantota districts. Total extent of chilli cultivation in the country during 1996/97 North - East monsoon season (maha) was 10,936 ha and out of this 70% has been cultivated in the North Central Province (NCP) which include Anuradapura and Polonnaruwa districts and Mahaweli 'H' area - Kalawewa electorate (Anon. 1996). Furthermore, extent of chilli cultivation in the country in 1995 has dropped by 35% when compared with the extent in the year 1993 (Anon. 1993a & Anon. 1995a). The major reason for this decline has been the difficulty of managing leaf curl complex (LCC) (Anon. 1994a). Johnpulle (1939) reported its damage on chilli plant in Sri Lanka for the first time.

Leaf curl complex in chilli is mainly caused by thrips-*Scirtothrips dorsalis* Hood, mites-*Hemitarsonormus latus* (Banks) and white flies - *Bemisia tabaci* Genn. Of them, thrips is presently considered as the most important causal agent for chilli leaf curl complex (Anon 1994a & Anon 1994b). Thrips feed by rasping epidermal and mesophyll tissues (Biddle *et al.* 1992; Lewis 1973). Thus it can cause considerable yield loss to the chilli crop (Fernando and Peiris 1957; Peiris 1953). Though most of the farmers in Mahaveli 'H' area adopted the recommended insecticides, correct time interval and number of applications per season, they did not use correct dosages, concentrations and spray volumes when applying insecticides for the control of pests in chilli in 1987 yala season (Dharmasena 1994). Seven to eight insecticide applications per season were found to be adequate for the effective control of pests in chilli (Dharmasena 1994). However, farmers in the same area in the year 1994 were of the view that the insecticides should be applied at 3 day intervals for a moderate control of thrips in chilli (Anon 1994a & Anon 1994b). This clearly implies the indiscriminate use of insecticides by farmers. This

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Abbreviations: LCC- Leaf curl complex in chilli; NCP- North Central province; WAT- Weeks after transplanting

has aggravated the problem of leaf curl complex in chilli and has resulted in reducing the extent of chilli cultivation in the country (Anon. 1994b).

In an effort to introduce a package of management practices for the control of LCC in chilli, a research managed demonstration was conducted at Eppawala in the Mahaveli 'H' area, in 1995 yala season and similar demonstrations have been carried out by the Extension Service in all the major chilli growing areas in the NCP. Therefore, the present study was carried out in the NCP to observe whether the farmers are aware of the newly introduced package of management practices and to identify short-comings in the awareness programme.

MATERIALS AND METHODS

Three to five farmers were randomly selected from each Agriculture Instructor Division in the Anuradhapura and Polonnaruwa districts and from each Unit Manager Division in the Mahaveli 'H' area. Areas where there was no large extent of chilli cultivations were avoided. A group of 75 randomly selected farmers were participated in the survey. A questionnaire was given to them at the beginning of the season. Necessary instructions were given as to how the questions should be answered. All the questionnaires were collected at the end of the season after careful checking and making the necessary corrections.

RESULTS AND DISCUSSION

Varietal resistance is a factor needed to minimize pest damage, but 8% of the farmers were not aware of the variety that they have cultivated (Table 1). Although Arunalu is comparatively tolerant compared to existing varieties (Anon. 1993b), none of the farmers cultivated it. Since chilli is a cross

Table 1. The major chilli varieties grown and the source of seed purchase in the North Central Province, Sri Lanka. South-west monsoon season, 1996 (n = 75).

Variety	% reported	Source	% reported
MI - 1	4.0 (3)†	Local market	69 (52)
MI - 2	58.7 (44)	Dept. of Agriculture	8 (6)
KA - 2	29.3 (22)	Own seed	20 (15)
Unknown	8.0 (6)	Neighbouring farmer	3 (2)

† Figures in parenthesis are actual values

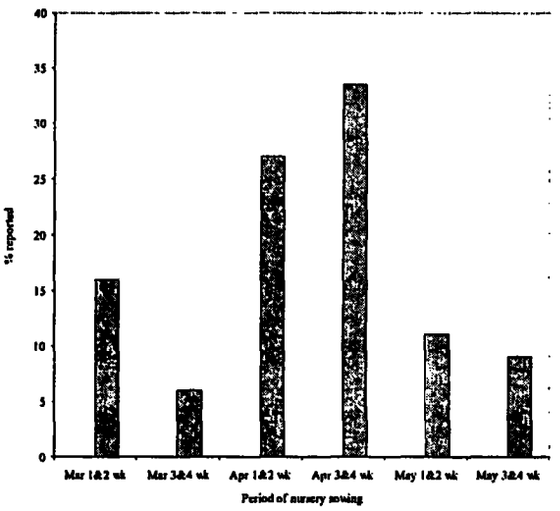

Fig. 1. Period of nursery sowing of chilli during the South-West monsoon season, 1996 in the North-Central Province of Sri Lanka

pollinated crop (Perera *et al.* 1996), it is important to obtain seeds from a reliable source. Nevertheless, most of the farmers (69%) buy seeds from local market and the expected varietal purity is not found in the crop.

Results of the present study show that only 21% of the farmers sow their nurseries in March as recommended by the Department of Agriculture (Anon. 1995b) while majority of the farmers sow in April (60%) and May (19%) (Fig 1). Therefore, majority (79%) of the farmers plant the crop in the field in May and June, because it takes 30 to 35 days for the chilli seedlings to attain the correct maturity for transplanting. Out of the three causal agents of LLC in chilli, thrips - *Scirtothrips dorsalis* is the most prevalent pest since it has been reported by

Table 2. The major pests and symptoms reported and their incidence in chilli in the North Central Province, Sri Lanka. South-west monsoon season, 1996 (n = 75).

Pest/Symptom	% reported
Thrips	72.2 (54)
White flies	5.3 (4)
Mites	2.7 (2)
Browning of leaves	9.3 (7)
Pod borers	5.3 (4)
Aphids	5.3 (4)

Figures in parenthesis are actual values

72% of the farmers (Table 2). This is an indication that late planted crop has been subjected to severe damage by thrips. Wijeratne (1994) reported that proliferation of thrips is rapid towards the end of yala season. Sivanathan (1982) reported that leaf curl

Table 3. Insecticide applications and the intervals adopted by the farmers for the chilli crop in the North Central Province, Sri Lanka. South-west monsoon season, 1996 (n = 75).

Number of applications		Intervals of applications	
No. of sprays	% reported	Days	% reported
3 - 4	22.7 (17)	3 - 6	16.1 (12)
5 - 6	18.7 (14)	7 - 11	48.0 (36)
7 - 8	30.7 (23)	12 - 16	27.9 (21)
9 - 10	22.7 (17)	17 - 21	8.0 (6)
More than 10	5.3 (4)	-	-

Figures in parenthesis are actual values

Table 4. Insecticides and spray volumes used by farmers during South-west monsoon Season, 1996 for chilli in the North-Central Province, Sri Lanka (n=75).

Insecticide	% reported	Volume of the spray mixture, l ha^{-1}	% reported
Imidacloprid*	15.5 (81)	1st month	
Prothiophos*	11.1 (16)	100 - 150	12.1 (15)
Profenaphos*	10.5 (55)	151 - 200	25.2 (31)
Acephate*	4.2 (22)	201 - 250	17.2 (21)
Phaseolin*	3.4 (18)	251 - 300	6.5 (8)
Endosulphan	16.8 (88)	301 - 350	4.9 (6)
Dimethoate	10.1 (53)	351 - 400	13.8 (17)
Monocrotophos	9.2 (48)	401 - 500	20.3 (25)
Chlopyripho	4.2 (22)	2nd month	
Chlofuazuron	6.1 (32)	150 - 250	1.2 (3)
Quinilphos	5.7 (30)	251 - 350	8.8(23)
Carbosulphan	1.1 (6)	351 - 450	10.0 (26)
Pirimiphos-methyl	1.0 (5)	451 - 550	23.1 (60)
Methomidiphos	1.0 (5)	501 - 700	11.5 (30)
		701 - 1000	14. 6 (38)
		1001 - 1500	21.5 (56)
		1501 - 2000	5.8 (15)
		more than 200	3.5 (9)

* Recommended insecticides. Figures in parentheses are actual values.

disease in chilli is high during dry weather in July and August, in the late yala season. Therefore, farmers spray insecticides as there is no other suitable method in controlling thrips in chilli. Safe use of insecticides is the only method available for the control of thrips in chilli under such circumstances (Wijeratne 1994). Leaf curl damage due to mites and whiteflies was very much lower (Table 2). Podborer damage as reported by 5.3% of the farmers is less important but browning of leaves as reported by 9.3 % of the farmers is becoming increasingly important. The causal agent of this disease has not yet been identified.

According to the survey conducted in the Mahaveli 'H' area during the South - West monsoon season, 1994, most of the farmers (77%) apply insecticides at 3 - 8 day intervals and some farmers (25%) apply 15 - 23 times per season for the chilli crop (Dharmasena *et al.* 1994). According to Jayantha (1994), in the year 1994, only 26% of the farmers in Mahaveli 'H' area have applied insecticides in 12 - 15 day intervals. Results of the present study conducted after the demonstrations in previous year indicate that 84% of the farmers apply insecticides in 1 - 3 week intervals and 95% of the farmers apply insecticides 3 - 10 times during the season (Table 3). This indicates that the farmers in the NCP are of the view that frequent application of

Table 5. Dosages and concentrations of imidachloprid applied to the chilli crop by farmers in the North-Central Province, Sri Lanka during the South-west Monsoon Season, 1996 (n= 75).

Dosage l ha^{-1}	%reported	Concentration ml l^{-1}	% reported
0 - 100	4.9 (4)†	0.0 - 0.4	6.5 (5)
100 -200	19.8(16)	0.5 - 0.8	13.6(11)
201 - 300	19.8(16)	0.9 - 1.2	76.5(62)
301- 400	8.6(7)	<1.2	6.2(5)
401 - 500	29.6(24)		
501 - 600	4.9(4)		
601 -700	7.4(6)		
701 - 800	0.0(0)		
<800	4.9(4)		

†Figures in parenthesis are actual values

insecticides is not necessary for the effective control of LCC in chilli and it is a step forward in the right direction.

Forty five percent of the insecticide applications have been made with the insecticides recommended for chilli leaf curl complex (Table 4). However, according to the report from Mahaveli 'H' area, in the year 1994, only 38% of the farmers had applied the recommended insecticides (Jayanatha 1994). Many farmers (46%) use more than 700 litres of spray mixture per hectare in the second month after planting though they apply less than 450 litres during the first month (Table 4). However, in 1994 yala season, 85% of the farmers in Mahaveli H' area had applied 625 - 3950 litres of spray mixture per hectare (Dharmasena *et al.* 1994). If the canopy is big, it might require up to 700 litres for effective control of thrips in chilli. Application of higher spray volume on sparse canopy on the other hand result in the draining of insecticide solution on to the ground.

Table 6. Fertilizer application adopted by the farmers (%) for chilli in the North-Central Province, during South-west Monsoon Season, 1996 (n= 75).

Dosage kg ha^{-1}	Urea	V mixture/TDM#	Chilli † fertilizer
	Basal application		
0 - 50	0 (0)	0 (0)	0
51 - 100	4.5 (1)	0 (0)	0
101 - 150	13.4 (3)	9.1 (2)	0
151- 200	4.5 (1)	0	0
101 - 250	4.5 (1)	18.2 (4)	4.1 (1)
above 250	9.1 (2)	27.2 (6)	4.5 (1)
	Second application		
0 - 50	0 (0)	1.3 (1)	0 (0)
51 - 100	5.3 (4)	0 (0)	0 (0)
101 - 150	10.6 (8)	0 (0)	1.3 (1)
151- 200	8.0 (6)	1.3 (1)	2.7 (2)
101 - 250	10.6 (8)	5.7 (5)	2.7 (2)
251 - 300	2.7 (2)	4.0 (3)	6.7 (5)
301 - 350	0 (0)	2.7 (2)	1.3 (1)
351 - 400	1.3 (1)	0 (0)	4.0 (3)
above 400	9.1 (3)	10.7 (8)	10.7 (8)

(c) Number of application per season		(d) Fertilizer application before planting or within the first week of planting	
Number	% reported	Basal application	% reported
One	01.3 (1)		
Two	20.0 (15)		
Three	42.7 (32)	Applied	39.3 (22)
Four	21.4 (16)		
Five	12.0 (9)		
Six	2.7 (2)	Not applied	71.7 (53)

Figures in parentheses are actual values.

#V mixture; the basal application recommended for the rice crop is composed of 8 kg urea, 74 kg Concentrated Super Posphate and 18 kg Muriate of Potash. TDM; the top dressing recommended for rice crop is composed of 66 kg Urea and 34 kg Muriate of Potash. †See text.

However, in comparison with the previous studies, the present study shows that there is a little improvement as far as the spray volume, concentration and type of insecticides are concerned.

Of the five recommended insecticides, imidachlorprid is the best for managing LLC in chilli and the correct dosage and the concentration are 500 - 750 ml/L and 1.0 ml/L respectively (Anon. 1995b). Although 77% of the farmers had used the correct concentration of imidachlorprid in their applications, only 42 % had used the correct dosage (Table 5).

Fertilizer applied at the correct rate and time is useful for better crop growth and plant vigour. Such plants are less susceptible to pests and diseases. Results of the present study show that most of the farmers (63%) apply fertilizer only 2 - 3 times for the chilli crop (Table 6). Fertilizer recommendation of the Department of Agriculture for chilli is 150 kg ha^{-1} of basal mixture (Chilli fertilizer) in the form of Triple Super Phosphate (TSP) and Muriate of Potash (MOP) at the rate of 100 kg and 50 kg respectively and 65 kg ha^{-1} of urea each at 2,4,8 & 12 weeks after transplanting (WAT) and 50 kg of Muriate of Potash at 8 WAT (Anon. 1990). Nevertheless, only 12 % of the farmers apply fertilizer 5 times for the chilli crop as recommended (Table 6). Seventy three percent of the farmers apply more than 150 kg of urea, V - mixture or chilli fertilizer as the basal application. Only 4.5% of the farmers apply the recommended rate of urea (51 - 100 kg ha^{-1}) while 94.5% apply excess amounts of urea or other types of fertilizer as the basal application. Most of the farmers (52%) apply more than 260 kg ha^{-1} of various types of fertilizer (four times the recommended rate of urea) for the second application or the first top dressing. Application of excess amount of fertilizer, especially urea leads to excessive vegetative growth and such succulent plants are susceptible to pests and diseases. Although basal fertilizer is useful for better crop growth, 71% percent of the farmers did not apply any fertilizer one week before or after transplanting the chilli crop. Population density of plant hoppers in the organically farmed rice field was lower than that of chemically fertilized fields (Kujumura *et al.* 1995). Thus, there is a possibility of reducing the pest damage by manipulating the fertilizer application in chilli as well.

Results show that the chilli crop planted in late yala season and application of high doses of N-fertilizer had severely been affected by LCC, compared to the crop with the recommended rate of N-fertilizer application and crop planted in early yala season (first two weeks of April). Therefore, an attempt should be made to minimize the pest damage in chilli by educating the farmer on rate and timing of fertilizer application and the importance of this practice as a part of an integrated crop management programme.

Since chilli is a cash crop, it is important to change the agronomic practices in such a way that the yield would be high with low pest damage and disease incidence. Furthermore, development of resistant/tolerant varieties for thrips, using sources such as Tiwari, Purple type and Tawahar 218, which are found to be adaptable under Sri Lankan situation would be useful to improve Crop Management Package in chilli (Perera *et al.* 1996). Therefore, future research activities should be focused to develop an integrated crop management package. In addition, presently available knowledge in this regard should be transferred to the farmers in an effective manner.

CONCLUSION

Late transplanting of chilli in May and June, excessive use of nitrogen fertilizer and lack of quality seeds are the major contributory factors for the spread of chilli leaf curl damage caused by *Scirtothrips dorsalis* Hood in the North Central Province of Sri Lanka. The proportion of farmers using recommended insecticides and proper time intervals for spraying has increased after the demonstrations conducted by the Department of Agriculture, but there is much room for improvement with regard to use of insecticides as well. Improper use of insecticides can severely aggrevate the problem of LCC.

It is necessary to implement an awareness programme to educate the farmers on the Integrated Crop Management package for chilli using the available information. In addition, future research activities should be focused on areas such as fertilizer application and varietal resistance in an attempt to improve the present Crop Management Package.

ACKNOWLEDGEMENTS

The author is grateful to the officers attached to the Extension Service of the Provincial Council of Anuradhapura and Polonnaruwa and Deputy Residential Project Manager and his staff of Mahaveli 'H' area for the support given in the survey.

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