Table 3: Effect of seed coating sorghum with herbicides on *Striga* emergence and sorghum performance

Treatment	*Striga* emergence (Plants/row sorghum)	Sorghum plant height (cm)
Local sorghum (no herbicide)	24	55.7
Epuripur		
No herbicide	17	70.6
With 2,4-D	2.3	62.2
With 2,4-DB	11.9	58.5
Sekedo		
No herbicide	10	87
With 2,4-D	11	74.9
With 2,4-DB	4.9	83.7
s.e.d	7.3	16.4

Table 4: Effect of three-year rotation of sorghum with trap crops on *Striga* emergence and sorghum performance

Rotation system	*Striga* emergence (Plants/row of Sorghum)	Sorghum Height (cm)	Sorghum Yield (kg/ha)
Cp-Ct-S-Ct-S-Cp-S	29	50.3	307
S-Ct-S-Ct-S-Ct-S	17.2	66.7	276
S-Cp-S-Cp-S-Cp-S	32.7	55.8	298
S-S-S-S-S-S	30.1	65.6	289
M-Cp-S-Cp-S-Cp-S	25.5	63.1	168
S-Ca-S-Ca-S-Ca-S	30	52.3	165
S-P-S-P-S-P-S	31.8	60.3	89
s.e.d	8	10.5	122

Cp=cowpea Ct=cotton M=millet Ca=*Celosia argentia*
P=sweet potatoes S=sorghum

SISN=40680

Development of IPM Technologies for Tomato In Central Uganda: Evaluation of Management Practices on Incidence of Late Blight on Tomatoes

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Abstract

The major production constraints of tomatoes, an important vegetable in Uganda, include Early and late blights (*Alternaria solani* and *Phytophthora infestans*), bacterial wilt (*Ralstonia solanacearum*), aphids, thrips, mites, and American bollworms (*Helicoverpa armigera*). Farmers use synthetic pesticides that are expensive, not readily accessible, sometimes adulterated, and may not be used correctly and in the right concentrations. The IPM-CRSP tomato program carried out an on-station trial to determine the effect of management practices on the incidence of *Phytophthora* and insect pests on tomatoes. The trellising, staking, mulching and yellow thrips traps reduced infection of late blight compared to other management practices. Highest total and marketable yields were obtained from mulched plots and those which had yellow thrips traps. Perhaps thrips are also a factor in either spreading the late blight pathogens, or reducing the plants' ability to resist the disease.

Objectives

1. To reduce the use of pesticides on tomatoes by developing alternative interventions for controlling priority pests of tomatoes.
2. To develop these methods in collaboration with tomato growers in Central Uganda.

IPM Constraints

Late Blight.

Research Methods

The study was done in the 2nd season of 2001 (2001b) and 1st season 2002 (2002a). The trial was laid out in a RCBD with 3 blocks which were split into 2 sub-plots, each with 7 sub-sub plots. In each block one sub-plot was sprayed with Dithane M-45 fungicide and the other was unsprayed. The management practices randomly allocated to the sub-sub plots were: 1. trellising; 2. staking; 3. dry grass mulch; 4. yellow thrips traps; 5. *Metarhizium*; 6. clean-weeding; 7. insecticide only. There were 3 rows per plot each with 6 plants. Plot size was 1.5 x 2.75 m, while spacing was 60cm (rows) x 45cm (plants). Guard rows were 2m wide. The variety MT56 was used in this study. Data were taken on pest incidence and severity, and tomato fruit yield.

Results

Late blight (*P. infestans*) scores for the two seasons are shown in Table 1. Plots sprayed with fungicide were less severely infected than those that received no fungicide, especially earlier in the seasons. In 2001b, plots treated with fungicide, those mulched, with yellow thrips traps, staked and weeded clean were the least affected by blight. In 2002a least infected plots were the staked, mulched, trellised, and with yellow thrips. Among the plots which received no fungicide in 2001b, the plots that were mulched, weeded clean and those had yellow thrips traps were least severely infected by late blight, while in 2002a plots least infected were those that were trellised, had yellow thrips traps, and those that were treated with *Metarhizium*.

Table 1. Late blight (*P. infestans*) scores (%) on tomato plants under different management practices in two seasons.

		2001b		2002a	
Fungicide	Management practice	13/12/01	19/12/01	24/5/2002	6/6/2002
Sprayed	Trellising	24	57	22	70
Sprayed	Staking	33	55	30	65
Sprayed	Mulch (grass)	32	42	15	67.5
Sprayed	Yellow thrips traps	27.5	52	28	68
Sprayed	*Metarhizium*	45	72	23	87
Sprayed	Clean weeding	25	55	35	72.5
Sprayed	Insecticide only	68	73	18	73
Unsprayed	Trellising	53	63	19	74
Unsprayed	Staking	52	63	32	88
Unsprayed	Mulch (grass)	55	62	30	88
Unsprayed	Yellow thrips traps	47	58	25	83
Unsprayed	*Metarhizium*	50	63	35	85
Unsprayed	Clean weeding	52	62	47	97
Unsprayed	Insecticide only	53	68	32	97

The tomato fruit yields of the 2 seasons are shown in Tables 2 and 3. There were significant differences between replicates all treatments except late blight in 2001b (Tables 2 and 3). Total and marketable yields were significantly different between plots that were sprayed and not sprayed with fungicide. Total yields were significantly different among the different management practices in both seasons. In 2001b (Table 2) highest yield was from the mulched plots and those that had yellow thrips traps. In 2002a (Table 3) highest yield was from the plots that received insecticide only, followed by those that were mulched. In 2001b the highest marketable yield was from mulched plots, followed by plots that had yellow thrips traps and those that were clean weeded. From the two seasons trials, mulching came out as the best treatment for reducing late blight severity on tomato plants, while at the same time giving high total and marketable yields. It was followed by staking and using yellow thrips traps to control thrips. Thrips could be a factor in either spreading the late blight pathogens, or reducing the plants' ability to resist the disease.

Impact

Previous work had shown that when rains are heavy, farmers cannot avoid using higher dosages of fungicide to control late blight. To solve this problem it was necessary to develop alternative IPM packages to control Late blight so as to reduce the use of fungicides and yet effectively control the disease. The work done in the last four seasons shows mulching and staking as practices which are promising in reducing Late blight severity, and thus potential for the reduction of fungicides applied to control the disease on tomato. These 2 practices will be taken on farm for final trial under farmers' conditions and demonstration, so that farmers can choose their preferred practice after their own assessment.

Networking Activities

Workshops: IPM CRSP Annual report preparation meeting, September 2001; IPM - CRSP Year 10 work plan meeting, March 2002; Virginia Tech – Makerere University-NARO GIS workshop: Using ARCVIEW, February 2002; Integrated Pest Management Conference for Sub-Saharan Africa, September 2002.

Highlights

Late blight severity is reduced by mulching using dry grass or straw, by staking, and by trellising, all which prevent direct contact of plants with soil. Mulching and staking also do not have adverse effects on total and marketable tomato yield.

Table 2. Tomato fruit yields (Y) (T/Ha) for 2001b under different management practices.

		Total Y	Mkrt Y[a]	Unmkt Y[b]	BactW Y[c]	Lblight Y[d]
Replicate	1	13.89 a	9.46 a	4.44 a	1.4 a	3.05
	2	12.34 a	8.79 ab	3.55 ab	0.96 b	2.59
	3	9.36 b	6.54 b	2.79 b	0.65 b	2.18
		lsd = 2.76	lsd = 2.51	lsd = 1.19	lsd = 0.43	ns
Fungicide	Sprayed	13.98 a	10.18 a	3.82	1.15	2.69
	Unsprayed	9.74 b	6.36 b	3.37	0.86	2.53
		lsd = 2.26	lsd = 2.05	ns	ns	ns
Managt.	Trellising	10.15 b	6.65 b	3.5 ab	1.0 abc	2.57
	Staking	10.8 b	7.25 b	3.52 ab	0.85 bc	2.72
	Mulch (grass)	16.18 a	11.27 a	4.92 a	1.63 a	3.3
	Thrips traps	13.48 ab	10.13 ab	3.33 ab	1.17 ab	2.15
	Metarhizium	10.08 b	7.18 b	2.93 b	0.8 bc	2.13
	Clean weeding	11.95 b	8.52 ab	3.43 ab	1.18 ab	2.25
	Insecticide only	10.38 b	6.85 b	3.53 ab	0.38 c	2.72
		lsd = 4.22	lsd = 3.84	lsd = 1.81	lsd = 0.66	ns

[a] marketable yield; [b] unmarketable yield; [c] bacterial wilt yield; [d] late blight yield

Table 3. Tomato fruit yields (T/Ha) for 2002a under different management practices.

		Total Y	Mkrt Y[a]	Unmkt Y[b]	BactW Y[c]	Lblight Y[d]
Replicate	1	4.48 b	2.39 b	2.09 b	0.57 b	1.52 b
	2	6.72 a	3.78 a	2.94 a	0.82 ab	2.11 a
	3	5.6 ab	3.19 ab	2.42 ab	1.02 a	1.4 b
		lsd = 1.22	lsd = 0.95	lsd = 0.71	lsd = 0.41	lsd = 0.55
Fungicide	Sprayed	6.82 a	4.08 a	2.75	1.03 a	1.72
	Unsprayed	4.39 b	2.17 b	2.22	0.58 b	1.63
		lsd = 0.99	lsd = 0.77	ns	lsd = 0.33	ns
Managt.	Trellising	4.4 c	2.38	2.02 b	0.93	1.09 b
	Staking	5.73 abc	3.38	2.35 ab	0.86	1.49 b
	Mulch (grass)	6.26 ab	3.23	2.52 ab	0.72	1.8 b
	Yell. thrips traps	5.26 abc	2.93	2.33 ab	0.83	1.5 b
	Metarhizium	5.78 abc	3.02	2.76 ab	1.03	1.73 b
	Clean weeding	4.87 bc	2.67	2.2 ab	0.78	1.41 b
	Insecticide only	6.95 a	3.25	3.2 a	0.47	2.72 a
		lsd = 1.86	ns	lsd = 1.09	ns	lsd =0.83

[a] marketable yield; [b] unmarketable yield; [c] bacterial wilt yield; [d] late blight yield

SISN=40501

Damage-Yield Relationships of Major Pests of Tomatoes in Central Uganda

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Abstract

Tomato production in Uganda is constrained by a host of pest and disease problems especially thrips (*Thrips tabaci*), aphids (*Myzus persicae*), whiteflies (*Bemisia tabaci*), American bollworm (*Helicoverpa armigera*), bacterial wilt (*Ralstonia solanacearum*) and early & late blights (*Alternaria solani* and *Phytophthora infestans*). To alleviate such problems, the IPM CRSP tomato program carried out two on-station trials, one to determine the effect of management practices [i.e., trellising, staking, mulching (dry grass), yellow sticky traps, *Metarhizium anisopliae* (a bio-pesticide), clean weeding (control) insecticides only] on the incidence of insect pests and late blight. The other aim was to determine the relationship between thrips population and tomato yield and to establish the economic injury levels (EILs). So far, trellising, *Metarhizium*, pesticide application and use of yellow thrips traps have been promising in reducing thrips populations on tomatoes compared to other management practices. Results for the second experiment showed a significant negative relationship between thrips densities and varying spray schedules. There was also a strong positive relationship between yield loss and thrips density in all the growing seasons and the EIL was set at 7 thrips per 3 leaves.

Objectives

- To determine the relationship between thrips population, damage, and tomato yields.
- To determine the effect of management practices on the incidence of insect pests on tomatoes.

IPM Constraints

- Participatory meetings with tomato farmers indicated that they sprayed at least once a week to control insect pests, particularly thrips. The insecticides applied are based on calendar sprays rather than need.