The Andhra Agric. J 62(4):853-858, 2015

Management Economics of *Urdbean* (*Vigna mungo*) Viral Diseases

N Janaki Ratnam, V Manoj Kumar, J Krishna Prasadji, M Adinarayana and P V Krishnayya
Department of Plant Pathology, Agricultural College, Bapatla 522 101, Andhra Pradesh

ABSTRACT

Field experiment was conducted during *rabi* 2013-14 for the management of virus diseases (*MYMV*, leaf curl and leaf crinkle) in *urdbean*. Among seven treatments tested in randomized block design with three replications, seed treatment with imidacloprid @ 5 g/kg seed followed by insecticidal spray with thiamethoxam @ 0.05 % at 30 DAS resulted in effective control of virus diseases and their vectors. Significant increase in shoot length, number of primary branches per plant, number of pods per plant, 100 seed weight, seed yield and highest B:C ratio was recorded with seed treatment with imidacloprid @ 5 g/kg seed followed by insecticidal spray with thiamethoxam @ 0.05 % at 30 DAS. Seed treatment followed by insecticidal protection at 30 DAS was found to be effective and economical in control of virus diseases and their vectors.

Key words : *MYMV,* Leaf crinkle, Leaf curl and Management.

Blackgram/*urdbean* (*Vigna mungo*) is one of the important pulse crops which is grown as a source of income and nutrition to billions of people in South East Asia. The crop is of special significance in Andhra Pradesh. As it fits well in rice – pulse cropping system as a relay crop particularly in Krishna – Godavari and North Coastal zones. Among the various pathogens that attack *urdbean*, viral diseases mainly *mungbean* yellow mosaic disease caused by whitefly transmitted *MYMV* (Nene, 1972; Singh, 1981) leaf curl disease caused by thrips transmitted *GBNV* (Nene, 1968; Reddy *et al*., 1995) and leaf crinkle disease caused by *Urdbean leaf crinkle virus* (Williams *et al*., 1968) are causing considerable loss annually. The control of insect vector is an important aspect for managing viral diseases. Hence, combination treatments were studied to manage the peak vector activity and consequently the viral diseases.

MATERIAL AND METHODS

Field trial was conducted during *rabi* 2013-14 at Agricultural College farm, Bapatla in a randomized block design with seven treatments replicated thrice (Gomez and Gomez, 1984). *Urdbean* variety LBG 623 was used in the study. Net plot size of 3 x 3 m was maintained for each treatment with 30 cm distance between rows and 10 cm between plants. All recommended agronomic practices were followed. The treatment details are given below

T1 : Seed treatment with Imidachloprid 75 W.G., @ 5 g / kg seed
T2 : T1+Spraying with Thiamethoxam 70 W.P., 0.05% at 30 DAS
T3 : T1+Spraying with Triazophos 40 E.C., 0.08% at 30 DAS
T4 : T1+Spraying with Acetamiprid 20 S.P., 0.004% at 30 DAS
T5 : T1+NSKE 5% spraying at 30 DAS
T6 : NSKE 5% spraying at 15 & 30 DAS
T7 : Untreated control

Per cent disease incidence was calculated by using the formula

$$PDI = \frac{\text{Number of plants infected in the microplot}}{\text{Total number of plants in the microplot}} \times 100$$

Whitefly and thrips population per trifoliate leaf were recorded at five days interval from 10 DAS to one week prior to harvesting. Shoot length, root length, number of primary branches per plant, number of pods per plant, 100 seeds weight, seed yield and B:C ratio were calculated separately for each treatment after crop harvest.

RESULTS AND DISCUSSION

Incidence of *MYMV* at 75 DAS was lowest in seed treatment with imidacloprid @ 5 g/kg and spraying with thiamethoxam @ 0.05 % at 30 DAS (51.82%) was on a par with seed treatment with

Table 1 Effect of insecticides on *MYMV* incidence and whitefly population during *rabi* 2013-14.

S.No.	Treatment	Per cent disease incidence					Whitefly population				
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
1	T_1: Imidacloprid (seed treatment)	0.00 (0.00)	1.04 (5.79)*	17.28 (24.58)	52.20 (46.28)	87.67 (69.48)	0.30 (0.55)**	2.77 (1.66)	4.37 (2.09)	10.87 (3.30)	7.87 (2.80)
2	T_2: T_1+Thiamethoxam spraying @ 0.05% at 30DAS	0.00 (0.00)	0.80 (5.11)	6.28 (14.50)	25.11 (30.08)	51.82 (46.07)	0.37 (0.61)	2.97 (1.72)	3.23 (1.80)	8.70 (2.95)	7.10 (2.66)
3	T_3: T_1+Triazophos spraying @ 0.08% at 30DAS	0.00 (0.00)	0.92 (5.42)	7.22 (15.57)	27.37 (31.55)	55.68 (48.28)	0.43 (0.66)	2.90 (1.70)	3.83 (1.96)	8.77 (2.96)	7.03 (2.65)
4	T_4: T_1+Acetamiprid spraying @ 0.004% at 30 DAS	0.00 (0.00)	0.92 (5.42)	6.88 (15.18)	26.94 (31.28)	52.63 (46.53)	0.33 (0.58)	3.10 (1.76)	3.57 (1.89)	8.87 (2.98)	7.17 (2.68)
5	T_5: T_1+NSKE 5% at 30 DAS	0.00 (0.00)	0.81 (4.97)	8.08 (16.49)	30.75 (33.69)	62.09 (52.02)	0.40 (0.63)	3.00 (1.73)	4.23 (2.06)	9.03 (3.01)	7.23 (2.69)
6	T_6: NSKE 5% at 15 & 30 DAS	0.00 (0.00)	0.58 (4.31)	8.42 (16.80)	36.91 (37.43)	65.29 (53.93)	0.67 (0.82)	2.63 (1.62)	4.20 (2.05)	9.07 (3.01)	7.37 (2.71)
7	T_7: Unsprayed check	0.00 (0.00)	3.35 (10.53)	28.06 (32.00)	63.62 (52.93)	91.35 (73.04)	0.93 (0.97)	3.87 (1.97)	6.57 (2.56)	11.50 (3.39)	8.73 (2.96)
	SEm ±	-	0.64	0.70	0.51	0.65	0.03	0.09	0.04	0.03	0.04
	CD (P d" 0.05)	-	1.99	2.16	1.58	2.00	0.10	0.30	0.14	0.10	0.12
	CV (%)	-	18.90	6.31	2.37	2.02	8.58	9.89	3.92	1.94	2.55

*Figures in parentheses are angular transformed values for *MYMV* disease incidence

** Figures in parentheses are square root transformed values for whitefly population

imidacloprid @ 5 g/kg and spraying with acetamiprid @ 0.04% at 30 DAS (52.63%). Average whitefly population per trifoliate leaf at 45 DAS was lowest in seed treatment with imidacloprid @ 5 g/kg and spraying with thiamethoxam @ 0.05% at 30 DAS (3.23) was on a par with seed treatment with imidacloprid @ 5 g/ kg and spraying with acetamiprid @ 0.04% at 30 DAS (3.57) (Table 1). Per cent disease incidence of leaf curl at 75 DAS was lowest in seed treatment with imidacloprid @ 5 g/kg and spraying with thiamethoxam @ 0.05% at 30 DAS (14.16%) and was on a par with seed treatment with imidacloprid @ 5 g/kg and spraying with acetamiprid @ 0.004% at 30 DAS (15.25%). Average thrips population per trifoliate leaf at 45 DAS was recorded and seed treatment with imidachloprid @ 5 g / kg seed followed by spraying with thiamethoxam (0.05%) at 30 DAS (3.77), seed treatment with imidachloprid @ 5 g / kg seed + spraying with acetamiprid 0.004% at 30 DAS (3.87) and seed treatment with imidachloprid @ 5 g / kg seed + spraying with triazophos @ 0.08% at 30 DAS (3.93) have showed significant reduction of thrips population and were on a par (Table 2). Incidence of *ULCV* at 75DAS was lowest in seed treatment with imidacloprid @ 5 g/kg and spraying with thiamethoxam @ 0.05% at 30 DAS (7.30%) was on a par with seed treatment with imidacloprid @ 5 g/kg and spraying with acetamiprid @ 0.04% at 30 DAS (7.57%) (Table 3).

Spread of viral diseases in *urdbean* at early stages of crop growth can be reduced by controlling viruliferous vectors with chemicals like thiamethoxam and acetamiprid at 30 DAS which in turn significantly increased the yield.

Table 2. Effect of insecticides on leaf curl incidence and thrips population during *rabi* 2013-14.

S.No.	Treatment	Per cent disease incidence					Thrips population				
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
1	T_1: Imidacloprid (seed treatment)	0.00 (0.00)	2.07 (8.26)*	9.33 (17.79)	18.66 (25.61)	21.08 (27.35)	0.33 (0.58)	2.10 (1.45)**	4.87 (2.21)	9.43 (3.07)	6.33 (2.52)
2	T_2: T_1+Thiamethoxam spraying @ 0.05% at 30DAS	0.00 (0.00)	1.82 (7.72)	5.71 (13.82)	11.54 (19.84)	14.16 (22.10)	0.27 (0.52)	1.90 (1.38)	3.77 (1.94)	8.07 (2.84)	6.00 (2.45)
3	T_3: T_1+Triazophos spraying @ 0.08% at 30DAS	0.00 (0.00)	2.18 (8.46)	6.30 (14.49)	12.60 (20.79)	15.58 (23.25)	0.37 (0.61)	1.93 (1.39)	3.93 (1.98)	8.40 (2.90)	6.07 (2.46)
4	T_4: T_1+Acetamiprid spraying @ 0.004% at 30 DAS	0.00 (0.00)	1.72 (7.51)	6.07 (14.25)	12.38 (20.61)	15.25 (22.99)	0.30 (0.55)	1.97 (1.40)	3.87 (1.97)	8.33 (2.89)	6.20 (2.49)
5	T_5: T_1+NSKE 5% at 30 DAS	0.00 (0.00)	1.39 (6.73)	7.16 (15.52)	13.88 (21.88)	16.88 (24.27)	0.43 (0.66)	1.77 (1.33)	4.27 (2.07)	8.90 (2.98)	6.23 (2.50)
6	T_6: NSKE 5% at 15 & 30 DAS	0.00 (0.00)	1.73 (7.54)	6.92 (15.20)	13.84 (21.84)	17.42 (24.67)	0.70 (0.84)	2.07 (1.44)	4.10 (2.02)	9.03 (3.01)	6.13 (2.48)
7	T_7: Unsprayed check	0.00 (0.00)	4.74 (12.56)	12.25 (20.48)	19.29 (26.05)	22.52 (28.34)	1.03 (1.02)	3.13 (1.77)	5.93 (2.44)	10.07 (3.17)	6.87 (2.62)
	SEm ±	-	0.49	0.39	0.38	0.37	0.03	0.06	0.03	0.02	0.05
	CD (P d" 0.05)	-	1.51	1.20	1.17	1.16	0.12	0.19	0.10	0.07	0.15
	CV (%)	-	10.13	4.24	2.94	2.64	10.09	7.45	2.84	1.43	3.56

*Figures in parentheses are angular transformed values for leaf curl incidence

** Figures in parentheses are square root transformed values for thrips population

Table 3. Effect of insecticides on leaf crinkle incidence during *rabi* 2013-14.

S.No.	Treatment	Per cent disease incidence recorded at 15 days interval				
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
1	T_1: Imidacloprid (seed treatment)	0.00 (0.00)	0.35 (3.37)*	2.88 (9.72)	8.76 (17.22)	12.33 (20.57)
2	T_2: T_1+Thiamethoxam spraying @ 0.05% at 30DAS	0.00 (0.00)	0.23 (2.24)	1.83 (7.76)	4.91 (12.80)	7.30 (15.68)
3	T_3: T_1+Triazophos spraying @ 0.08% at 30DAS	0.00 (0.00)	0.00 (0.00)	2.17 (8.45)	5.39 (13.41)	7.91 (16.32)
4	T_4: T_1+Acetamiprid spraying @ 0.004% at 30 DAS	0.00 (0.00)	0.11 (1.12)	2.07 (8.25)	5.17 (13.12)	7.57 (15.96)
5	T_5: T_1+NSKE 5% at 30 DAS	0.00 (0.00)	0.00 (0.00)	2.66 (9.39)	5.66 (13.76)	8.67 (17.13)
6	T_6: NSKE 5% at 15 & 30 DAS	0.00 (0.00)	0.35 (3.37)	2.77 (9.57)	5.88 (14.04)	9.23 (17.69)
7	T_7: Unsprayed check	0.00 (0.00)	0.58 (4.31)	4.51 (12.24)	11.43 (19.77)	13.74 (21.77)
	SEm ±	-	0.67	0.34	0.33	0.40
	CD (P d" 0.05)	-	2.06	1.05	1.01	1.24
	CV (%)	-	56.37	6.34	3.85	3.90

*Figures in parentheses are angular transformed values

Table 4. Effect of insecticides on growth and yield parameters during r*abi* 2013-14.

S.No.	Treatment	Root length (cm)	% increase over control	Shoot length (cm)	% increase over control	No. of primary branches per plant	% increase over control	No. of pods per plant	% increase over control	No. of seeds per pod	% increase over control	Seed yield (q/ha)	% increase over control	Test weight (g)	% increase over control
1	T_1: Imidacloprid (seed treatment)	13.09	1.2	31.11	5.8	10.07	11.0	17.20	8.9	5.07	8.6	6.52	9.99	4.37	5.3
2	T_2: T_1+Thiamethoxam spraying @ 0.05% at 30DAS	16.99	31.3	35.33	20.2	10.93	20.6	21.73	37.6	5.40	15.7	10.24	72.64	4.61	11.3
3	T_3: T_1+Triazophos spraying @ 0.08% at 30DAS	14.66	13.4	33.41	13.6	10.47	15.4	18.53	17.3	5.27	12.9	9.11	53.59	4.45	7.2
4	T_4: T_1+Acetamiprid spraying @ 0.004% at 30 DAS	16.79	29.8	35.26	19.9	10.73	18.4	19.73	24.9	5.20	11.4	9.59	61.65	4.51	8.8
5	T_5: T_1+NSKE 5% at 30 DAS	13.33	3.0	32.99	12.2	9.73	7.4	17.40	10.1	5.33	14.3	7.56	27.55	4.41	6.4
6	T_6: NSKE 5% at 15 & 30 DAS	13.42	3.8	31.69	7.8	9.53	5.1	17.87	13.1	5.13	10.0	6.77	14.12	4.39	5.8
7	T_7: Unsprayed check	12.93	-	29.41	-	9.07	-	15.80	-	4.67	-	5.93	-	4.15	-
	SEm ±	1.2		1.6		0.5		2.0		0.1		0.2		0.05	
	CD (P d" 0.05)	3.9		5.0		1.6		6.3		0.4		0.8		0.17	
	CV (%)	15.1		8.6		9.2		19.5		5.1		6.0		2.26	

Table 5. Economics of on viral diseases control in blackgram during *rabi* 2013-14.

S. No.	Treatment	Cost of cultivation (Rs/ha)	Yield (q/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C Ratio
1	T_1: Imidacloprid (seed treatment)	15400	5.92	23674.07	8274.40	0.54
2	T_2: T_1+Thiamethoxam spraying @ 0.05% at 30DAS	15840	9.79	39140.74	23301.07	1.47
3	T_3: T_1+Triazophos spraying @ 0.08% at 30DAS	15995	8.89	35540.74	19546.07	1.22
4	T_4: T_1+Acetamiprid spraying @ 0.004% at 30 DAS	15820	9.25	36992.59	21172.92	1.34
5	T_5: T_1+NSKE 5% at 30 DAS	15995	7.56	30251.85	14257.18	0.89
6	T_6: NSKE 5% at 15 & 30 DAS	16290	6.98	27911.11	11621.44	0.71
7	T_7: Unsprayed check	15100	5.54	22177.78	7078.11	0.47

The combination of seed treatment with imidacloprid 5 g/kg and spraying of thiamethoxam 0.05 % at 30 DAS has recorded the longest root length (16.99 cm) followed by seed treatment with imidacloprid 5 g/ kg seed and acetamiprid spray 0.004 % at 30 DAS (16.79 cm). The longest shoots were recorded in combination treatments of seed treatment with imidacloprid and spraying of thiamethoxam at 30 DAS (35.33 cm) and seed treatment with imidacloprid and acetamiprid spray at 30 DAS (35.26 cm) and were on a par. Seed treatment with imidacloprid and spraying of thiamethoxam at 30 DAS recorded 20.6% more primary branches (10.93) than unsprayed check (9.07) which was on a par when seed treatment was imposed with imidacloprid and acetamiprid spray at 30 DAS (10.73). All the treatments were on a par with each other for number of pods per plant. Seed number in all the treatments was significantly higher than in unsprayed check. Seed treatment with imidacloprid and spraying of thiamethoxam at 30 DAS gave the significantly highest 100 seed weight than rest of the treatments. The highest B:C of 1.47 was obtained for seed treatment with imidacloprid and spraying of thiamethoxam at 30 DAS (Table 4 & 5).

Thiamethoxam and acetamiprid controlled the whitefly population which led to a decrease in *MYMV* incidence. Mathirajan and Regupathy (2002) recorded minimum whitefly population and low incidence of *urdbean MYMV* when sprayed with thiamethoxam 25 WG @ 0.02 g/l at 15 DAS. Present results were also in concurrence with the investigation reports of Ganapathy and Karuppiah (2004), Hossain *et al*. (2010). Razaq *et al*. (2003) and Satish *et al.* (2004) reported the efficacy of thiamethoxam against thrips and the results of these investigation were in accordance with their reports. Prasadarao - *et al*. (2003) studies have revealed that seed treatment with imidacloprid followed by regular systemic insecticide spray in the early stages of the crop growth controlled thrips and thrips transmitted diseases. Sunkad and Naik (2013) reported the significance of systemic insecticides in the control of disease transmitting vectors.

Studies on viral disease management have revealed that the crop could be protected from heavy losses by seed treatment with imidacloprid @ 5 g/kg and spraying of insecticides like thiamethoxam @ 0.05%at 30 DAS and acetamiprid @ 0.004% at 30 DAS through vector control. Spraying of these two insecticides at 30 DAS could effectively influence the shoot length, number of primary branches per plant, number of pods per plant, 100 seeds weight, seed yield and B:C ratio. Seed treatment with imidacloprid and systemic insecticide spray at 30 DAS could keep the crop at low intensity of virus diseases through vector control at early stages of the crop and was found to be more economical.

LITERATURE CITED

Ganapathy T and Karuppiah R 2004 Evaluation of new insecticides for the management of whitefly (*Bemisia tabaci* Genn.), *Mungbean Yellow Mosaic Virus* (MYMV) and *Urdbean Leaf Crinkle Virus* (*ULCV*) diseases in *mungbean* (*Vigna radiata* (L.) Wilczek). *Indian Journal of Plant Protection,* 32: 35-38.

Hossain A S M A, Islam S M A S, Akhter K, Akhtar N and Muqit A 2010 Effect of plant extracts, insecticides and cultural practices on growth characters and disease severity of mungbean yellow mosaic. *International Journal of Sustainable Crop Production*, 5: 8-11.

Mathirajan V G and Regupathy A 2002 Toxicity of thiamethoxam to *Aphis gossypii*, *Amrasca devastans*, *Nilaparvata lugens* and *Sogotella furcifera*. *Annals of Plant Protection Sciences*, 10: 369-370.

Nene Y L 1968 Annual Report (No.1) Project, FG-In-358, Uttar Pradesh Agricultural University, Pantnagar, India.

Nene Y L 1972 A survey of the viral diseases of pulse crops in Uttar Pradesh, *First Annual Report*, *F. G – In-358*, Uttar Pradesh Agricultural University, pp:1-25.

Prasadarao R D V J, Reddy D V R, Nigam S N, Reddy A S, Waliyar F, Yallamanda Reddy T, Subramanyam K, Johnsudheer M, Naik K S S, Bandhyopadhyay A, Desai S, Ghewande M P, Basu M S and Somasekhar 2003 Peanut stem Necrosis: A new disease of groundnut in India. International Crop Research Institute for Semi Arid Tropics, *Information Bulletin No. 67*. Patancheru, Andhra Pradesh, India.

Razaq M, Aslam M, Iqbal M, Hussain M and Shahzad A 2003 Efficacy of six insecticides with different modes of action against sucking pests of cotton. *Sarhad Journal of Agriculture*, 19: 97-100.

Reddy D V R, Buiel A A M, Satyanarayana T, Dwivedi S L, Reddy A S, Ratna A S, Vijayalakshmi K, Rao G V R, Naidu R A and Wightman J A 1995a Peanut bud necrosis disease: an overview. pp: 3-7. *In recent studies on peanut bud necrosis disease*: proceedings of a Meeting, 20 March 1995, ICRISAT Asia Center, India (Buiel, A.A.M., Parlevliet, J.E. and Lenne J.M. eds.), Patancheru 502 324, Andhra Pradesh, India.

Satish M, Dharma Reddy K, Basappa H and Vinod Kumar Singh T 2004 Insecticidal management of *Thrips palmi* (Karny) on Sunflower. *Indian Journal of Entomology*, 66: 119-120.

Singh J P 1981 Effect of virus disease on growth components and yield of mungbean and urdbean. *Indian Phytopathology*, 33: 405-408.

Sunkad G and Naik M K 2013 Effect of peanut bud necrosis disease (PBND) on growth and yield parameters of groundnut at different stages of infection. *Indian Phytopathology,* 66: 406-407.

Williams F J, Grewal J S and Amin K S 1968 Serious and new diseases of pulse crops in India in 1966. *Plant Disease Reporter*, 52: 300-304.

(Received on 31.07.2015 and revised on 14.10.2015)