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Comparative efficacy of green labeled insecticides against *Spodoptera litura* on bidi tobacco at scarce rainfall zone of A.P

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Abstract
An experiment was conducted for three seasons at Regional Agricultural Research Station. Nandyal. Comparative efficacy of insecticides, *viz* Rynaxpyr 0.3ml/l, Spinosad 0.25ml/l, Novaluron 1ml/l, Emamectin benzoate 0.4gm/l and Chlorpyriphos 2.5ml of water against *Spodoptera litura* was carried out. All three insecticides Rynaxpyr 0.3ml/l, Spinosad 0.25ml/l, Novaluron 1ml/l, Emamectin benzoate 0.4gm/l and Chlorpyriphos 2.5ml, had non-significant difference among themselves in reducing the larval population of *Spodoptera litura*. at 3, 5 and 7 following the application of the insecticides. Rynaxpyr 0.3ml/l, Emamectin benzoate 0.4gm/l in reducing number of larvae on the basis of pre-spray data. Toxicity of Rynaxpyr 0.3ml/l, Emamectin benzoate 0.4gm/l and Spinosad 0.25ml/l was discussed.

Keywords: Bidi tobacco, insecticides, *Spodoptera litura*

Introduction
Tobacco, one of the important high value commercial crops in India, is valued for its potential to generate farm income and employment to farmers and farm labours and revenue to the government. Its is grown in area of 0.433 M ha in the country with a production of 721M kg India ranks third in the world tobacco production (Anonymous, 2017) [1]. Tobacco leaf eating, caterpillar *(Spodoptera litura* F.) is a serious pest in tobacco nurseries and main field. The pest causes damage to an extent of 80-100% in the nurseries under favourable conditions (Chari *et al.*, 1994) [2] and loss in the field crop (Sitararnaiah *et al.*, 2001) [9] and hence is a limiting factor in the production of quality leaf. Farmers resort to chemical sprays to limit the menace by this pest. Application of monocrotophos or endosulfan or quinalphos as spray was found highly effective in managing the larval population (Prasad *et al.*, 1980). Among the various insect pests attacking this crop, leaf eating caterpillar, *S. litura*, commonly known as tobacco caterpillar, a polyphagous pest is found in entire groundnut growing countries in Asia, Australia and the Pacific basin (Feakin, 1973) [3] and causes extensive damage to the crop at its initial stage. This pest now became serious one on groundnut crop in Gujarat State. Hence, this type of study is now became useful for the long term management of this pest. As *S. litura* is one of the important pests and causes considerable damage to the crop, blanket use of insecticides have recommended for the effective and economic control of the pest in groundnut. The injudicious application of insecticides created many adverse effects resulting into environmental pollution and health hazards and development of resistance in S. litura to several insecticides.
Previously tried insecticides against insect pests of tobacco crop included endosulfan 35EC, deltamethrin 2.3EC, ethophinprox 30EC, monocrotophos 40WSC, demeton S-methyl 45EC, dimethoate 40EC, methamidophos 60Sl (Hussain & Shah, 1998) [6]. Insecticides from different sources ought to be tested against *H. armigera* and *Spodoptera* spp., because both pests insects are polyphagous and they shift to sunflower following tobacco in certain places where tobacco is extensively grown such as Kurnool Dist. A.P

Materials and Methods
The experiment was carried out during 2012-13, 2015-16 and 2016-17 at Regional Agricultural Research Station. Nandyal. The trial was laid out in Randomized Block Design (RBD) with four treatments including a control and replicated thrice with A119 bidi variety. Plot size was 6 X 6 m^2 with row to row and plant to plant distance were 75 X 75 cm,

respectively. Five insecticides Rynaxpyr 20SC @ 0.3ml/l, Spinosad 45 SC @ 0.25ml/l, Novaluran 10EC @ 1ml/l, Emamectin benzoate 5%SG @ 0.4gm/l and Chlorpyriphos 20 EC @2.5 ml of water. The control plots were sprayed with water only. Data on number of larvae of *Spodoptera litura* were taken from five randomly selected plants from each treatment plot just before and then after 3, 5 and 7 days of application of the insecticides.

The data thus obtained were converted into per cent mortality by using the formula given by Abbott (1925) and modified by Henderson and Tilton (1955) and analyzed statistically.

Corrected per cent mortality = $100 \times \{1-T_a \times C_b / T_a \times C_b\}$

Where, Ta = Number of larvae recorded after treatment

Tb = Number of larvae recorded before treatment

Ca = No of larvae recorded from check plot after treatment

Cb = No of larvae recorded from check plot before treatment

Yield components were recorded and Cost Benefit Ratio (CBR) was worked out. The mean larval number from each treatment were compared by Duncan's Multiple Range Test after One Way ANOVA at α= 5%.

Results and Discussion

A) Pest incidence

The three years pooled analysis data was presented in the Table -1 indicated that all the treatments gave significantly better control than untreated check. In the day before spraying *Spodoptera litura* population was ranged from 15.00 to 22.40 that is above ETL level.

At 3 days after spray all treatment significant the superior over the control treatment. The least (0.02) mean no. of larvae population with 99.54% ROC was noticed in the treatment Rynaxpyr 0.3ml/lit which was at par with treatment Novaluron 1 ml/lit and Emamectin benzoate 0.4 gm/lit which recorded 0.15 and 0.20 mean no. of larvae /plant with 97.08 and 96.21% ROC respectively. the highest number of larvae population was recorded control treatment (15.67).

At 5 days after spray the least number 0.00 mean number of larvae population was recorded in the treatment rynaxpyr 0.3 ml/lit 100% ROC which at par with treatment Novaluron 1 ml/lit recorded 0.49 mean no. of larvae/plant with 86.21% ROC.

At 7 days after spraying all the treatments superior over the control the *Spodeptera litura* larvae except control treatment which recorded 15.83 mean no. of larvae/plant. The lowest mean no. of *Spodeptera litura* larvae population was recorded in the treatment rynaxpyr 0.3ml/lit (0.75) with 96.50% ROC which was followed by Emamectin benzoate 0.4gm/lit which recorded 0.45 mean no. of larvae/plant with 91.37% ROC. Overall average larvae ROC was noticed in treatments rynaxpyr 0.3ml/lit with 96.50 and which was followed on par with Emamectin benzoate 0.4 gm/lit Novaluron 1ml/lit 89.18 and87.36 in ROC respectively.

B) Cured leaf yield and Cost benefit ratio

The pooled cured leaf yield was recorded the highest cured leaf yield was recorded in this treatment Rynaxpyr 0.3 ml/lit with 1161 which was followed with treatment Novaluron 1ml/lit and Emamectin benzoate which recorded 1151 and 1089 kg/ha respectively and least cured leaf yield was noticed in the control treatment with 910 kg/ha.

These results are in agreement with Patil *et al* 2014, Evaluated the various insecticides against *S. litura* and found chlorantraniliprole 30 g a.i. ha-1, methomyl300 g a.i. ha-1 and spinosad 75 g a.i. ha-1 were most effective insecticides in protecting the soybean crop from infestation of *S. litura.* The results of the present investigation substantially supported by the findings Hanning *et al.* (2009) concluded that Ecotoxicological safe profile with reducing risk to the applicator novel molecule, chlorantraniliprole induce feeding cessation in time span when compared with broad spectrum insecticides like Methomyl. Gadhiya *et al.* (2014) [4] also found chlorantraniliprole (0.006%) and spinosad (0.018%) were found effective and statistically at par with each other in protecting the groundnut crop from the infestation of *Spodoptera litura* (Fab.) and Helicoverpa armigera (Hubner).

Table I: Mean larval number plant^{-1}of *Spodoptera litura* at pre- and post-spray intervals of application of insecticides

Treatments		Mean No. larvae plant							Over all mean% ROC	Cured leaf kg/ha	CB ratio
		DBS	DAS (3rd)	% ROC	DAS (5th)	% ROC	DAS (7th)	% ROC			
T1	Rynaxpyr 0.3ml/l	15.20 a (3.94)	0.02 a (0.72)	99.54	0.00 a (0.71)	100.00	0.15 a (0.80)	96.50	98.68	1160.93	1:2.36
T2	Spinosad0.25ml/l	19.02 ab (4.41)	0.68 a (1.06)	87.45	1.28 a (1.31)	65.83	0.65 a (1.06)	87.88	80.40	1086.49	1:2.34
T3	Novaluron 1ml/l	18.05 ab (4.25)	0.15 a (0.80)	97.08	0.49 a (0.99)	86.21	1.08 a (1.21)	78.78	87.36	1150.92	1:2.26
T4	Emamectin benzoate 0.4gm/l	18.50 ab (4.35)	0.20 a (0.83)	96.21	0.73 a (1.11)	79.96	0.45 a (0.97)	91.37	89.18	1088.78	1:2.38
T5	Chloripyriphos 2.5ml/l	20.15 ab (4.54)	0.38 a (0.94)	93.38	1.38 a (1.36)	65.22	0.96 a (1.21)	83.11	80.57	1040.82	1:2.22
T6	Control	22.40 b (4.78)	15.67 b (3.96)	-	22.67 b (4.78)	-	15.83 b (4.00)	-	-	911.01	1:1.56
	F test	NS	S		S		S			S	
	SeM+	0.21	0.21		0.2		0.23			45.6	
	CD(0.05)	0.65	0.68		0.63		0.72			129.36	

DBS: Days before Spraying

DAS: Days after Spraying

Values in Parentheses are square root transformed value

Means followed by same letters are not significantly different at $p<0.05$ by DMRT

% ROC – Per cent Reduction over Control

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