Mysore J. Agric. Sci., 50 (1) : 54-60, 2016

Effect of Fabric Treatment with Newer Insecticides Against *Carryedon serratus* (Oliver) on Groundnut

G. T. Thirumala Raju and B. L. Jyothi
AICRP on Seed Technology,UAS, GKVK Bengaluru-560 065

Abstract

The experiment was carried out with four different insecticides *viz.*, Flubendiamide 480 SC @100 ppm a.i., Emamectin benzoate 5 SG @100 ppm a.i., Spinosad 45 SC @100 ppm a.i., Deltamethrin 2.8 EC @100 ppm a.i., Untreated control and three different storage bags of Gunny bag, Porous High Density Polyethylene (HDPE) bag and Cloth bag to evaluate their efficacy for controlling *Caryedon serratus* (Oliver) on storability of groundnut pods under ambient conditions during 2010 to 2013. The results revealed that spinosad 45SC @100 ppm a.i. was most effective by recording highest (85.59 per cent) germination and least (1.98 %) pod damage among the insecticides. However, with respect to packaging material the highest (83.31 %) germination and least (3.52 %) pod damage was observed in Porous HDPE bags. Among the interactions, the HDPE bags treated with spinosad 45SC @100ppm a.i recorded highest (86.22 %) germination and least (1.67 per cent) pod damage at nine months after treatment imposition closely followed by emamectin benzoate 5SG @100 ppm a.i with 85.11 per cent germination and 1.98 per cent pod damage. The cost benefit ratio also revealed the highest 1:3.75 with HDPE bags treated with spinosad 45 SC.

Groundnut is the sixth most important oil seed crop in the world. It contains 48-50 per cent oil and 26-28 per cent protein and is a rich source of dietary fiber, minerals and vitamins. The pod borer *Caryedon serratus* (Oliver) is one of the major and important storage insect species causing 20 per cent damage (Dick, 1987) to groundnut and prevalent in Asia, Greece, France, Italy and the north and West coasts of Africa). In field condition, 6.8 per cent pod damage is noticed due to *C. serratus* in *A.nilotica* (Singal and Toky, 1990). Groundnut stored in godown was attached by the bruchid, *Caryedon serratus* causing approximately 17-47 per cent of the pod damage (Shukla and Rathore, 2007). Recently most of the farmers are not storing the pods for seed purpose due to menace of this pest. No information is available on the pest with respect to management of the pest by fabric treatment. Hence, an attempt has been made on find out suitable packaging materials as well as new insecticide molecules as fabric treatment for management of this insect pest.

Material and Methods

A laboratory experiment was carried out to know the efficacy of newer insecticide molecules treated on different packaging materials at All India Coordinated Research Project on Seed Technology, National Seed Project, University of Agricultural Sciences, Bengaluru during 2010-13. One kilogram of freshly harvested certified groundnut pods having highest germination and optimum moisture content were taken for each treatment. The experiment was initiated by adopting Factorial Completely Randomized Design with following treatments in three replications. The treatments were

Treat-ments	Treatment details	Concentration of a.i. (ppm)	Quality of formulation (litre/g) for fabric treatment
T_1	Flubendiamide 480 SC	100	0.2
T_2	Emamectin benzoate 5 SG	100	2.0
T_3	Spinosad 45 SC	100	0.2
T_4	Deltamethrin 2.8 EC	100	3.5
T_5	Untreated control		

Packaging material (2kg capacity each)

1. Gunny bag
2. Porous High Density Polyethylene bag (HDPE)
3. Cloth bag

Insecticidal solutions were prepared as mentioned above and treated on package material with 7.5ml spray fluid per bag of 30X40cm dimension. After shade drying of treated packaging material, pods were filled in bags and kept for storage under ambient conditions. The germination test was conducted by adopting between paper method as prescribed by ISTA (2010). Moisture content of groundnut seeds was estimated by oven drying method by taking 5 grams of groundnut seeds from each replication and treatment. The groundnut seeds were grinded and kept in oven for 17 hours and final weight was recorded. The moisture content of groundnut seed was calculated by using following formula.

$$\text{Moisture content (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Whereas, W_1 = weight of empty cup with lid (g)

W_2 = weight of cup with groundnut seed samples before drying (g)

W_3 = weight of cup with groundnut seed sample after drying (g)

Observations on per cent pod damage was recorded as per the method prescribed by International Seed Testing Association (ISTA, 2010) by randomly drawing four hundred pods from each treatment and replication, number of damaged pods were counted and expressed as per cent damage by using following formula.

$$\text{Per cent pod damage} = \frac{\text{Number of pods damaged}}{\text{Total number of pods}} \times 100$$

Results and Discussion

All the insecticidal treatments were on par with each other with respect to germination and insect damage and differed significantly only with untreated control at three months after storage. The highest (91.22 %) germination and least (0.14 %) insect damage was observed in bags treated with spinosad 45 SC @100 ppm which was on par with all other treatments and differed significantly over untreated control which recorded least (87.15 %) germination and highest (0.64 %) insect damage. No significant differences were observed among the packaging materials with respect to germination and insect damage (Table I). However, the highest (90.87 per cent) germination and least (0.23 %) damage were observed in pods stored in porous HDPE bags. Significant differences were observed among the interactions between treatments and packaging materials. The highest (92.00 % each) germination was recorded in spinosad 45 SC treated gunny bags (T_3P\) and spinosad 45 SC treated HDPE bags (T_3P_2) which differed significantly over all other interactions and the least was in untreated cloth bags (T_5P_3) 86.44 per cent followed by untreated gunny bags (T_5P_1) (86.56 %). However, significant differences were not observed with respect to moisture content among the treatments, packaging materials and interactions between them at three months after storage.

Significant differences were observed with respect to germination and pod damage among treatments, packaging materials and their interactions at six months after treatment imposition. The highest (88.48 %) germination was observed in spinosad 45 SC @100 ppm which was on par with emamectin benzoate 5 SG @ 100 ppm (87.93 %) and flubendiamide 480SC @100 ppm (87.22 %) and differed significantly with remaining treatments. The least (82.30 %) germination was observed in untreated control which was significantly inferior to all other treatments. The least (1.37 %) pod damage was observed in spinosad 45SC @100 ppm and was on par with all other treatments except untreated control (5.11 %). Among the packaging materials porous HDPE bag recorded highest (87.15 %) germination followed by gunny bag (86.55 %) and cloth bag (86.00 %). However, significant differences were not observed among the

TABLE I

Influence of different treatments and packing materials on germination, moisture content and pod damage of groundnut at three months after storage during 2010-2013 (Pooled data)

Treatments	Germination (%)				Moisture content (%)				Pod damage (%)			
	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean
T_1 = Flubendiamide 480SC 100 ppm a.i.	90.4 ^{ab}	91.56 ^{a}	89.78 ^{ab}	90.60 ^{a}	7.76	7.62	7.49	7.62	0.14 ^{a}	0.15 ^{a}	0.14^{a}	0.14 ^{a}
T_2 =Emamectin benzoate 5SG 100 ppm a.i.	91.11 ^{ab}	91.78 ^{a}	90.33 ^{ab}	91.07 ^{a}	7.56	7.49	7.87	7.64	0.11 ^{a}	0.12 ^{a}	0.26 ^{ab}	0.17 ^{a}
T_3 =Spinosad 45SC 100 ppm a.i	92.00 ^{a}	92.00 ^{a}	89.67 ^{ab}	91.22 ^{a}	7.60	7.61	7.45	7.55	0.11 ^{a}	0.17 ^{ab}	0.15 ^{a}	0.14 ^{a}
T_4 = Deltamethrin 2.8EC 100 ppm a.i	88.11 ^{ab}	90.55 ^{ab}	88.33 ^{ab}	89.00 ^{ab}	7.62	7.76	7.68	7.69	0.18 ^{ab}	0.11 ^{a}	0.18 ^{ab}	0.16 ^{a}
T_5 = Untreated control	86.56 ^{b}	88.44 ^{a}	86.44 ^{b}	87.15 ^{b}	7.68	7.77	7.69	7.71	0.59 ^{bc}	0.60 ^{bc}	0.73 ^{c}	0.64 ^{b}
Mean	89.64	90.87	88.91		7.64	7.65	7.64		0.23a	0.23 a	0.29 a	

	Germination SEm±	Germination CD (0.05)	Moisture SEm±	Moisture CD (0.05)	Pod damage SEm±	Pod damage CD (0.05)
Treatments (T)	0.95	2.74	0.266	NS	0.087	0.26
Packaging Material	0.74	NS	0.206	NS	0.067	NS
T x M	1.65	4.76	0.461	NS	0.151	0.43
CV (%)	3.18		10.45		104.89	

P_1, P_2, P_3: Gunny bag, Porous HDPE bag and Cloth bag, respectively

NS: Non significant

Means followed by same alphabet in a column do not differ significantly

MAT: Months after treatment;

TABLE II

Influence of different treatments and packing materials on germination, moisture content and pod damage of groundnut at six months after storage during 2010-2013 (Pooled data)

Treatments	Germination (%)				Moisture content (%)				Pod damage (%)			
	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean
T_1 = Flubendiamide 480SC 100 ppm a.i.	87.44 [ab]	88.00 [ab]	86.22 [b]	87.22 [ab]	8.94	8.72	9.00	8.89	2.06 [a]	1.57 [a]	2.08 [a]	1.90 [a]
T_2 =Emamectin benzoate 5SG 100 ppm a.i.	88.00 [ab]	88.11 [ab]	87.67 [ab]	87.93 [ab]	8.60	8.69	8.85	8.71	1.69 [a]	1.46 [a]	1.93 [a]	1.6 9[a]
T_3 =Spinosad 45SC 100 ppm a.i	88.67 [ab]	88.78 [a]	88.00 [ab]	88.48 [a]	8.90	8.76	8.82	8.23	1.48 [a]	1.27 [a]	1.35 [a]	1.37 [a]
T_4 = Deltamethrin 2.8EC 100 ppm a.i	86.45 [ab]	87.66 [a]	86.67 [ab]	86.93 [b]	8.69	8.85	8.79	8.77	1.64 [a]	1.52 [a]	1.91 [a]	1.69 [a]
T_5 = Untreated control	86.56 [b]	88.44 [a]	86.44 [b]	87.15 [b]	7.68	7.77	7.69	7.71	0.59 [bc]	0.60 [bc]	0.73 [c]	0.64 [b]
Mean	89.64	90.87	88.91		7.64	7.65	7.64		0.23a	0.23 a	0.29 a	

	Germination SEm±	Germination CD (0.05)	Moisture SEm±	Moisture CD (0.05)	Pod damage SEm±	Pod damage CD (0.05)
Treatments (T)	0.51	1.47	0.484	NS	0.407	1.18
Packaging Material	0.40	1.15	0.375	NS	0.315	NS
T x M	0.88	2.54	0.839	NS	0.704	2.02
CV (%)	1.76		16.47		51.87	

P_1, P_2, P_3: Gunny bag, Porous HDPE bag and Cloth bag, respectively

NS: Non significant

Means followed by same alphabet in a column do not differ significantly

MAT: Months after treatment;

TABLE III

Influence of different treatments and packing materials on germination, moisture content and pod damage of groundnut at nine months after storage during 2010-2013 (Pooled data)

Treatments	Germination (%)				Moisture content (%)				Pod damage (%)			
	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean	P_1	P_2	P_3	Mean
T_1 = Flubendiamide 480SC 100 ppm a.i.	82.78 ^{ab}	84.33 ^{ab}	81.45 ^{b}	82.85 ^{ab}	10.17	10.11	10.31	10.20	3.14 ^{a}	2.32 ^{a}	3.02 ^{a}	2.83 ^{a}
T_2 =Emamectin benzoate 5SG 100 ppm a.i.	84.22 ^{ab}	85.11 ^{ab}	82.45 ^{ab}	83.93 ^{ab}	10.24	10.22	10.31	10.26	2.36 ^{a}	1.98 ^{a}	2.50 ^{a}	2.28 ^{a}
T_3 =Spinosad 45SC 100 ppm a.i	85.56 ^{ab}	86.22 ^{a}	85.00 ^{ab}	85.59 ^{a}	10.45	10.20	10.52	10.39	2.03 ^{a}	1.67 ^{a}	2.25 ^{a}	1.98 ^{a}
T_4 = Deltamethrin 2.8EC 100 ppm a.i	81.44 ^{ab}	82.67 ^{ab}	81.33 ^{ab}	81.81 ^{ab}	10.33	10.12	10.36	10.27	3.00 ^{a}	2.39 ^{a}	3.58 ^{a}	2.99 ^{a}
T_5 = Untreated control	76.78 ^{b}	78.22 ^{ab}	76.44 ^{b}	77.15 ^{b}	10.39	10.19	10.41	10.33	11.27 ^{bc}	9.25 ^{bc}	12.97 ^{c}	11.16 ^{b}
Mean	82.16	83.31	81.33		10.31	10.17	10.38		4.36 ^{ab}	3.52 ^{a}	4.86 ^{b}	

	Germination SEm±	Germination CD (0.05)	Moisture SEm±	Moisture CD (0.05)	Pod damage SEm±	Pod damage CD (0.05)
Treatments (T)	1.94	5.60	0.641	NS	0.515	1.54
Packaging Material	1.50	NS	0.497	NS	0.414	1.19
T x M	3.37	9.73	1.111	NS	0.927	2.68
CV (%)	7.08		18.70		37.78	

P_1, P_2, P_3: Gunny bag, Porous HDPE bag and Cloth bag, respectively

NS: Non significant

Means followed by same alphabet in a column do not differ significantly

MAT: Months after treatment

TABLE IV

Cost benefit ratio for adopting fabric treatment of different treatments and packing materials

Chemicals	Dosage/it	Quality required per 3 bags	Cost of 3 bags + chemicals	Damage (%)	Loss due to damage (Rs.)	Total loss (Rs.) / Qtl	C:B
Flubendiamide 480 SC 100 ppm ai + Gunny bag	0.2ml	0.03ml	130-00	3.14	157.00	287.00	2.41
Flubendiamide 480 SC 100 ppm ai + HDPE bag			54-00	2.32	117.50	171.50	3.01
Flubendiamide 480 SC 100 ppm ai + Cloth bag			115-00	3.02	151.00	266.00	2.87
Emamectin benzoate5 SG 100 ppm ai + Gunny bag	2g	0.2g	130-00	2.36	118.00	248.00	2.79
Emamectin benzoate5 SG 100 ppm ai + HDPE bag			54-00	1.98	99.00	153.00	3.37
Emamectin benzoate5 SG 100 ppm ai + Cloth bag			115-00	2.50	125.00	240.00	3.18
Spinosad 45 SC 100 ppm ai + Gunny bag	0.2ml	0.03ml	130-00	2.03	101.50	231.50	2.99
Spinosad 45 SC 100 ppm ai + HDPE bag			54-00	1.67	83.50	137.50	3.75
Spinosad 45 SC 100 ppm ai + Clothbag			115-00	2.25	112.50	227.50	3.35
Deltamethrin 2.8EC 100 ppm ai + Gunny bag	3.5ml	0.35ml	130-00	3.00	150.00	280.00	2.47
Deltamethrin 2.8EC 100 ppm ai + HDPE bag			54-00	2.39	119.50	173.50	2.98
Deltamethrin 2.8EC 100 ppm ai + Cloth bag			115-00	3.58	179.00	294.00	2.60
Untreated control + Gunny bag	-	-	130-00	11.27	563.50	693.50	-
Untreated control + HDPE bag			54-00	9.25	462.50	516.50	-
Untreated control + Cloth bag			115-00	12.97	648.50	763.50	-

Cost of pod Rs. 5000/qtl

packaging materials with respect to pod damage. The interaction between insecticides and packaging material revealed highest (88.78 %) germination in spinosad 45 SC @100 ppm treated HDPE bags which was on par with most of the interactions except flubendiamide 480 SC treated cloth bags (86.22 %) and all types of untreated cloth bags which were significantly inferior to all the interactions. The least pod damage (1.27 %) was found to be in spinosad 45 SC treated HDPE bags (T_3P_2) which was on par with all other interactions and all of them differed significantly with bags which were not treated (Table II). Significant results were not observed with respect to moisture content. However, the least (8.23 %) moisture content was in spinosad 45SC treated bags among the treatments, the HDPE bags (8.80 %) with packaging material and in interactions emamectin benzoate 5SG treated gunny bag (8.60 %).

After nine months of storage, significant differences were observed among treatments, packaging materials and their interactions with respect to germination as well as pod damage. The highest (85.59 %) germination and least pod damage (1.98 %) were observed with spinosad 45 SC @100 ppm and was on par with all other treatments and all of them differed significantly over untreated control. The least (77.15 %) germination was in untreated control which was on par with deltamethrin 2.8EC (81.81 %) and significantly inferior to all other treatments. The highest (11.16 %) pod damage was in untreated bags. Significant differences were not observed with respect to packaging materials. However, the highest (83.31 %) germination was in HDPE bags. Significantly least (3.52 %) pod damage was observed in HDPE bags which was on par with gunny bags (4.36 %) and differed significantly with cloth bag (4.86 %). Among the interactions between treatments and packaging materials the highest (86.22 %) germination was observed in spinosad 45 SC treated HDPE bags (T_3P_2) which was on par with all other interactions and differed significantly with untreated cloth bags (T_5P_3) (76.44 %) interaction. Whereas, the least pod damage (1.67 %) was found to be in spinosad 45 SC treated HDPE bags (T_3P_2) which was on par with all other treatments except untreated bags and the highest (12.97 %) pod damage was observed in untreated cloth bags (T_5P_3) which was significantly inferior to all other interactions (Table III). Significant results were not observed with respect to moisture content. However, the least (10.20 %) moisture content was in flubendiamide 480SC treated bags, 10.17 per cent in porous HDPE bags and 10.11 per cent in flubendiamide 480SC treated HDPE bags.

Cost benefit ratio was also calculated to know which treatment and packaging material was most effective to farming community. The data revealed that (Table IV) the highest cost benefit ratio of 1:3.75 was in spinosad 45 SC @100 ppm treated porous HDPE bags which was far above than all other treatment combinations. The next best in order was emamectin benzoate 5SG @100 ppm treated porous HDPE bag (1:3.37) followed by spinosad 45 SC@100 ppm treated cloth bag (1:3.53).

The above findings revealed that spinodsad 45 SC @100 ppm treated porous HDPE bags were effective in managing groundnut pod borer *Caryedon serratus* upto nine months without affecting the seed quality parameters. These findings are new and no work has been done on these aspects except Lal and Dikshit (2001) by using deltamethrin 2.8 EC on jute bags at 15 and 25 mg / m^2 could able to store the seeds up to six months. These are new findings helpful to the farming community.

References

Dick, K. K., 1987, Pest management of stored groundnut, ICRISAT, Patancheru, PP.28.

ISTA, 2010, *International rules for seed testing*, Zurich, Switzerland

Lal, A. K. and Dikshit, A. K., 2001, The protection of Chikpea (*Cicer arietinum* L.) during storage using deltamethrin on sacks. *Pesticide Res. J.*, **13**(1): 27-31.

Singal, S. K. and Tokoyo, O. P., 1990, Carryover of bruchid *Carryedon serratus* (Oliver) (Coleoptera) from field to stores through seeds of *Acacia nilotica* in India. *Trop. Pest Mangt.*, **36**: 66-67.

Shukla, A. and Rathore, S. S., 2007, Incidence of bruchid, *Carryedon serratus* (Oliver) on groundnut in Jaipur, Rajasthan. *Entomon.*, **32**(3): 225-226.

(***Received :*** September, 2015 ***Accepted :*** January, 2016)