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Effect of pre-harvest sanitation sprays on seed quality characters of greengram

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ABSTRACT
Effect of pre-harvest sanitation sprays revealed that, spraying of endosulfan 0.07% ten days before harvest of the crop was the most effective in preventing bruchid infestation totally on pods and seeds both immediately after harvest and after 25 days of storage. The trials conducted during winter and summer seasons expressed that summer season was favourable for production of insect free seed.

Key words : Endosulfan, Sanitation sparays, Seed quality, Greengram.

INTRODUCTION

Seed quality is a complex character and is determined by both field and storage factors. Among the field factors, season of cultivation, availability of nutrients, soil moisture, plant density and incidence of pests and diseases play a major role in production of quality seed (Agrawal, 1995). Of which the occurrence of pest and diseases often cause major reduction both in yield and quality in any seed production programme. In pulses the bruchids are the main pests of stored seeds. bruchids (*Callosobruhus spp.*) are field carry over pest as they lay eggs in the field before harvest and get manifested during storage and cause pronounced loss (Howlader and Matin, 1988).

As per the ancient adage, "Prevention is better than cure", controlling these pests in the field prevents them from entering godowns and spreading further to uninfected seeds. Pre-harvest sanitation spray is a novel method to arrest these pathogens / insects in the field itself thereby delimiting the damage during storage. It involves the spraying of fungicides and / or insecticides during the formation and development of pod and seed at needy concentrations at suitable intervals (Vijayakumar, 2001).

Bruchids,*Callosobruchus spp*. belonging to the family bruchidae, order Coleoptera is the most destructive field carry over pests of stored pulses especially whole seeds (Howlader and Matin, 1988). Prevett (1961) reported that at last stage of maturation, seeds are infested by bruchids either from field or by the bruchids migrating from infested seeds of adjacent granaries or from seed godown which do not have expression at field. Hence studies were initiated with greengram cv. CO 6 to evaluate the influence of pre-harvest sanitation sprays on bruchid infestation and seed quality characteristics of resultant seeds as a step for insect free seed production.

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MATERIALS AND METHODS

Genetically pure, freshly harvested breeder seeds of greengram (*Vigna radiata* L.Wilczek) cv. CO 6 obtained from Agricultural Research Station, Bhavanisagar (11°29' latitude, 77°08' longitude) served as the base material for the field experiments.

The field trials were conducted during winter 2004 and summer 2005 at farmer's field (Semmanich-ettipalayam village of Coimbatore district) with greengram cv. CO 6 adopting Randomized Block Design with five treatments and three replications. The crop was raised with recommended package of practices in a plot size of 4 x 5 m^2 under irrigated condition. Ten days before harvest i.e.60 days after sowing the crop was imposed with pre-harvest sanitation sprays using endosulfan 0.07%, neem oil (TNAU neem formulation) 3%, neem dust (TNAU formulation) @ 25 kg ha^{-1} and Neem Seed Kernal Extract @ 5% (NSKE) with knapsack sprayer as prophylactic measure against bruchid infestation. The unsprayed plots served as control. At harvest, 10 plants were selected randomly in each of the treatment and replication and observed for the following parameters *viz*.,pods $plant^{-1}$, infested pods $plant^{-1}$ (%), eggs (infested) pod^{-1}, eggs100 $seed^{-1}$.

The infested pods as such and seeds separated from infested pods obtained were stored in paper bag for a duration of 25 days (2 days after the life cycle of bruchids) and were evaluated for bruchid emergence pod^{-1} (%) and following seed quality characters.

The damaged seed (%) was calculated by dividing number of damaged seed by total number of seeds taken for counting which is multiplied by 100 (Mohan,1993). The germination test was carried out with 100 x 4 seeds (ISTA, 1999). Ten normal seedlings are selected from

Table 1 : Influence of pre-harvest sanitation sprays on pod and insect infestation characters

Seasons (S) / Spray treatments (T)	Pods plant^{-1}			Infested pods plant^{-1} (%)			Eggs (infested) pod^{-1}			Eggs 100 seed^{-1}		
	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean
Endosulfan	111	93	102	3.83	2.29	3.04	3.0	2.0	2.5	0	0	0
Neem oil	105	89	97	4.08	2.88	3.48	5.0	3.0	4.0	0	0	0
Neem dust	102	90	96	4.00	3.27	3.64	6.0	3.0	4.5	1	1	1
NSKE	110	93	102	3.92	2.67	3.30	5.0	4.0	4.5	0	0	0
Unsprayed	103	87	95	6.69	5.49	6.09	9.0	6.0	7.5	7	2	5
Mean	106	90	98	4.50	3.31	3.91	5.8	3.4	4.6	1.6	0.6	1.2
CD (P=0.05)	T	S	TS	T	S	TS	T	S	TS	T	S	TS
	NS	3.158	NS	0.667	0.422	NS	1.206	0.762	NS	0.144	0.909	NS

each treatment and dried under shade for two days followed bu oven at 80^{0} C for 16 hours and used for estimation of drymatter production (Gupta, 1993). The vigour index was computed following the formula of Abdul-Baki and Anderson (1973). The data gathered were analysed statistically adopting the procedure described by Gomez and Gomez (1984). Wherever necessary, the percentage values were transformed to angular (arc sine) values, before carrying out the statistical analysis.

RESULTS AND DISCUSSION

The results of the preharvest sanitation spray revealed that the seed crop sprayed with endosulfan 0.07 % and NSKE 5 % recorded the highest pod number plant^{-1} (102). It was followed by neem oil spray (97) and neem dusting (96), while the unsprayed crop recorded the lowest pod number (95) plant^{-1} which was 6.9 per cent lower than plots sprayed with endosulfan. Between the seasons, significant variations were observed for the pods plant^{-1} which was higher in winter (106) than in summer (90). The infested pod percentage was higher in unsprayed crop and it was lower with all the other spray treatments. Within the sprays, pods received with endosulfan spray recorded the minimum percentage of pod infestation (3.04 per cent) highlighting the better efficacy of pesticidal spray treatment in control of field carry over of bruchid infestation compared to botanicals. Among the botanicals, NSKE at 5 per cent (3.30 per cent) performed better than others (Table 1).

The endosulfan spray served as an effective control measure against the carry over of field infestation of bruchid and thereby maintained the plant health at higher order. Sasikala (1994) in cowpea and Vijayakumar (1996) in bhendi also obtained similar reduced infestation percentage in pods of crop sprayed with endosulfan. The effective control of pests concomitant with spraying of endosulfan might be due to the polychlorinated pesticidal effect that enter or centre together with the electron on negative side with double bond and the presence of 'S' atoms might have showed the highest lethal activity (Sekharan, 1978 and Gupta, 2001). The infested pods percentage was lower in crop sprayed with NSKE 5 per cent which might be due to the presence of azadirachtin the active ingredient in neem which was structurally similar to the insect molting hormone ecdysone and interacts with carpus cardiacum, thereby blocking the activity of the molting hormones. As such, this compound acts as an insect growth regulator suppressing fecundity, molting, pupation and adult formation and the other constituents showing high potency of insects, structurally related to azadirachtin are the salamin, maliantrol and nimbin which serves as a potential insecticide activating

Table 2 : Influence of pre-harvest sanitation sprays on insect infestation and seed quality characters after 25 days of infested pod storage

Seasons (S) Spray treatments (T)	Bruchid emergence (%)			Damaged seed (%)			Germination (%)			Drymatter production 10 seedlings^{-1} (mg)			Vigour index		
	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean
Endosulfan	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	89 (70.64)	89 (70.74)	89 (70.69)	70	71	71	6232	5323	5778
Neem oil	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	87 (68.90)	88 (69.77)	88 (69.34)	69	70	70	6004	6164	6084
Neem dust	3 (9.55)	1 (4.79)	2 (7.17)	2 (6.73)	1 (4.79)	2 (5.76)	87 (68.87)	88 (69.74)	88 (69.31)	69	70	70	6004	6161	6083
NSKE	2 (6.73)	0 (0.52)	1 (3.63)	1 (5.61)	0 (0.52)	1 (3.06)	88 (69.77)	89 (70.74)	89 (70.26)	70	71	71	6163	6321	6242
Unsprayed	7 (15.32)	4 (11.28)	6 (13.30)	7 (15.10)	2 (9.88)	5 (12.49)	87 (68.88)	87 (70.06)	87 (69.47)	68	69	69	5977	6097	6037
Mean	2.4 (6.53)	1.0 (3.53)	1.7 (5.02)	2 (5.70)	0.6 (3.24)	1.3 (4.47)	88 (69.42)	88 (70.22)	88 (69.81)	69	70	70	6076	6013	6045
CD (P=0.05)	T	S	TS	T	S	TS	T	S	TS	T	S	TS	T	S	TS
	3.196	2.021	NS	3.040	1.927	NS	1.007	NS	NS	NS	NS	NS	NS	NS	NS

(Figures in parenthesis indicates arc sine values)

indigestion and affecting a diversity of insects (Schmutterer, 1995) might be the cause for the protection rendered by this treatment against the insect infestation in the present study even at field level. Umarani and Vanangamudi (1999) also revealed that neem products develop the seed hardiness and prevented the bruchid infestation. In addition, neem products also had anti-oxidant property like acetyl salicylic acid that reduced the lipid peroxidation, protein degradation and chromosomal aberrations and thereby controlled the seed deterioration process.

In the present investigation not only the percentage of infested pod, but also the number of eggs per infested pod were also in line with the above said efficacy of spray treatments. The number of eggs was maximum with pods of unsprayed plots (7.5) while the least was by pods of endosulfan 0.07 per cent spray (2.5) which was 66 per cent lesser than pods of unsprayed plots. The observation on carry over of eggs through seed from the infested pod also expressed that pods of unsprayed plot transmitted 60 per cent infestation to seed while it was nil in plots sprayed with endosulfan. Within the botanicals the carry over infestation by seed through infested pod was in the order of 0, 1 and 0 which were 100, 77 and 100 per cent lesser than the pods of unsprayed plots indicating the carryover of nil infestation to seed even if the pods were infested with eggs of bruchids after the pre-harvest sanitation spray treatments with the efficacy order of NSKE, neem dust and neem oil. Between the seasons, irrespective of spray treatments, the eggs infested pod^{-1} and eggs100 seed^{-1} was lower in summer compared to winter. In the present investigation, the eggs observed pod^{-1} was 3.4 and 5.8, respectively with summer and winter season (Table 1).

The evaluation made on eggs for their emergence as adult after their life cycle of 23 days from the infested pod stored as pod and seeds extracted from infested pod immediately after harvest and stored as seed revealed that in both of them, resultant seeds of unsprayed crop recorded higher percentage (6 and 3 %) of bruchid emergence while it was nil in other spray treatments expressing that endosulfan was superior in controlling the field carry over of insect infestation and was followed by NSKE. Similar efficacy of endosulfan spray on arresting the bruchid emergence when applied as pre-harvest sanitation spray had been reported by Sasikala (1994) in cowpea and Patrick (1998) in peas. While the efficacy exerted by NSKE on control of bruchid emergence could be due to the hindrance developed against oviposition, hatching and adult emergence of *Callosobruchus maculatus* as

Table 3 : Influence of pre-harvest sanitation sprays on insect infestation and seed quality characters after 25 days of seed storage from infested pod

Seasons (S) Spray treatments (T)	Bruchid emergence (%)			Damaged seed (%)			Germination (%)			Drymatter production 10 seedlings^{-1} (mg)			Vigour index		
	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean	Winter	Summer	Mean
Endosulfan	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	90 (71.62)	90 (71.69)	90 (71.66)	70	70	70	6304	6395	6350
Neem oil	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	88 (69.74)	89 (70.68)	89 (70.21)	69	69	69	6073	6145	6109
Neem dust	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	89 (70.74)	89 (70.74)	89 (70.74)	69	69	69	6143	6143	6143
NSKE	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	0 (0.52)	90 (71.70)	90 (71.80)	90 (71.75)	70	70	70	6363	6302	6332
Unsprayed	4 (11.28)	1 (4.79)	3 (11.81)	4 (10.87)	1 (4.79	3 (11.81)	88 (69.77)	88 (69.83)	88 (69.80)	68	68	68	5989	5846	5918
Mean	0.8 (2.67)	0.2 (1.37)	0.5 (2.02)	0.8 (2.59)	0.4 (1.37)	0.5 (1.98)	89 (70.71)	89 (70.95)	89 (70.84)	69	69	69	6174	6166	6170
CD (P=0.05)	T	S	TS	T	S	TS	T	S	TS	T	S	TS	T	S	TS
	1.878	NS	NS	2.363	NS	NS	1.018	NS	NS	1.143	NS	NS	144.442	NS	NS

(Figures in parentheses indicates arc sine values)

expressed by Makanjuola (1989) with cowpea. Similar results were also expressed with NSKE spray by Geethalakshmi (1997) and Raja (2000) in greengram. Between seasons, the bruchid emergence was higher in the pods obtained during winter (2.4 %) which was 1.4 percent higher than summer crop irrespective of spray treatments. Anon (1990) revealed that in pod storage the bruchid emergence percentage was higher compared to seeds extracted from infested pods.

In line with the infestation level, the damaged seed percentage was also highest in pods and seeds of unsprayed plots, but it was 2 per cent higher in infested pods stored as such compared to seeds of infested pod stored after extraction as seeds (Table 2 &3). The reduction of damaged seed percentage in the sprayed plots due to their insecticidal property was also supported by Yeshbirsingh and Singh (1997) in mungbean, and Patrick (1998) in peas. Between the seasons also, the damaged seed percentage expressed wider variation recording 0.6 and 2.0 per cent of damaged seed in infested pod storage and 0.4 and 0.8 per cent in seed storage respectively in summer and winter seasons which was in line with results obtained for bruchid emergence highlighting summer as the best season for lesser carry over of bruchid infestation from field. Similar variation in damaged seed due to seasons was also reported by Sasikala (1997) in cowpea and Vijayakumar (2001) in bhendi.

The seed quality evaluations expressed an indirect relationship between infestation level and seed quality characters by recording the maximum germination (89 and 90 %) with endosulfan and NSKE sprayed plots and the minimum with unsprayed plots (87 and 88 %). The other seed quality evaluations made on drymatter production 10 seedlings^{-1} (mg) and vigour index with the seeds obtained from infested pod and seeds extracted

from infested pod (immediately after harvest) was higher with the resultant seeds of endosulfan and NSKE sprayed plots while it was least with the seeds of unsprayed plots. Among the neem based botanicals used for spray, the performance of NSKE was better than neem oil and neem dusting in preservation of seed quality characters in terms of vigour expression. Similar improvement in seed quality characters with spray treatment was reported by Tittaren and Varis (1963) and Kathiravan (2001) which was attributed to the terminal residue of pesticides that favour the production of gibberellic acid that resulted in better germination and seedling measurement. The influence of season on seed quality characters expressed a non-significant difference irrespective of spray treatments. The interaction effect between the seasons and spray treatments were non significant, indicating that the role of pre-harvest sanitation spray was wider in control of bruchid infestation irrespective of seasons. Dakshinamurthy (1986), Balan (1988), Khoa (1992) in rice and Patrick *et al*. (2000) in peas also exposed the benevolent effect of pre-harvest sanitation spray on seed germination and the vigour parameters due to the endogenous regulation of growth substances.

In conclusion, the crop sprayed with endosulfan 0.07 %, ten days before harvest effectively reduced the bruchid infestation at field level as well as at storage conditions followed by NSKE 5 % spray. Between the seasons, the infestation level was lesser in summer with higher seed quality characters, irrespective of spray treatments.

REFERENCES

Abdul-Baki, A.A. and Anderson, J.D. (1973). Vigour determination in soybean seed by multiple criteria. *Crop Sci*., **13 :** 630-633.

Agrawal, R.L. (1995). Seed Technology. Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.

Balan, S. (1988). Seed technological studies on paddy. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Dakshinamurthy, A. (1986). Bioecology and management of *Sitotroga cereallela* Olivier in rice. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Geethalakshmi, L. (1997). Management of pulse beetle *Callosobruchus maculatus* (F.) (*Coleoptera ; Bruchidae)* on greengram (*Vigna radiata* (L.) Wilczek) in storage. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Gomez, K.A. and Gomez, A.A. (1984). Statistical procedures for Agricultural Research. A. Wiley, Inter-Science Publication, Jhon Wiley Sons, New York.

Gupta, P.C. (1993). Seed vigour testing. Hand book of seed testing. Quality Control and Research Dev., New Delhi. pp.243.

Gupta, H.C.L. (2001). In : Insecticides *: Toxicology and uses*. Agrotech Publishing Academy, Udaipur, pp : 185-210.

Howlader, A.J. and Matin, A.S.M.A. (1988). Observations on the pre-harvest infestation of paddy by stored grain pests in Bangladesh. *J. Stored Products. Res.,* **24(4) :** 229-231.

ISTA (1999). International rules for seed testing. *Seed Sci. & Technol.,* **27 :** Supplement rules.

Khoa, N.T. (1992). Influence of supplemental pre-harvest sanitation application of insecticides on seed quality characteristics of rice. M.Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Makanjuola, W.A. (1989). Evaluation of extracts of neem (*Azadirachta indica* A. Juss) for the control of some stored product pests. *J. Stored Product Res.,* **25:** 231-237.

Mohan, S. (1993). A new device to trap pulse beetle. TNAU News letter, **23(2):** 1.

Patrick, J. (1998). Studies on seed production and storage aspects of pea (*Pisum sativum* L.). M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Patrick J., Palanisamy, V. and Vakeswaran, V. (2000). Influence of pre-harvest sanitation sprays on seed yield of pea (*Pisum sativum*, L.). *Seed Res.,* **28(1):** 99-101.

Sasikala, K. (1994). Studies on the influence of pre-harvest spraying of pesticides on seed yield and quality in cowpea cv. CO 4. M.Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Sasikala, K. (1997). Studies on the influence of pre-harvest spraying of pesticides on seed yield and quality in cowpea cv. CO 4. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Schmutterner, H. (1995). Neem tree-source of unique natural products for integrated pest management, medicine industry and other purposes. UCH, Weinheim, pp. 696.

Sekharan, S. (1978). Seed quality in sesame (*Sesamum indicum* L.) cv. KRR 2 and TMV 3 influenced by pesticides applied to mother crop. M.Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Umarani, R. and Vanangamudi, K. (1999). Improvement in storability of *Casuarina equisetifolia* seeds through pre storage treatments by triggering their physiological and biochemical properties. National symposium on Forestry Towards 21st Century Sep. 27-28. Tamil Nadu Agricultural University, Coimbatore.

Vijayakumar, A. (1996). Seed technological studies in bhendi. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore.

Vijayakumar, A. (2001). Effect of pesticides spray on resultant seed quality in bhendi.*Madras Agric.J.,* **88(719):** 482-483.

Yeshbir Singh and Singh, S.P. (1997). Reduction of pulse beetle *Callosoburchus chinensis* (L.) incidence in mungbean crop. *Indian J. Entomol.,* **59(3) :** 340-341.

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