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## Effect of new insecticide molecule on insect management and seed quality attributes in maize (*Zea mays* L.)

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### Abstract

A field experiment was conducted at National Seed Project, UAS, GKVK, Bengaluru during the year 2018-19, to know the effect of new insecticide molecule called chlorantraniliprole on quality attributes in maize inbred line CAL 1443. The experiment was laid out in RCBD, replicated three times with ten treatment combinations, Chlorantraniliprole 0.1, 0.2, 0.3 ml / kg (ST) Chlorantraniliprole 0.1 ml 0.2, 0.3 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS, Chlorantraniliprole 0.1, 0.2, 0.3 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS, Control. The results revealed that Chlorantraniliprole 0.3 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS recorded least per cent leaves damage and highest Seed quality attributes viz., least percent leaves damage at 60 DAS (7.37 %), Seed germination (93.00 %), mean seedling length (33.65 cm), mean seedling dry weight (56.10 mg), seedling vigour index I (3103) and seedling vigour index II (5216) over control (90.33 %, 23.40 %, 31.91 cm, 55.41 mg, 2914, 5005 respectively).

**Keywords:** Insecticide molecule, seed quality, maize

### Introduction

Maize (*Zea mays* L.) is the important cereal crop in the world after wheat and rice. It is much significant crop in United States of America like rice and wheat are in India. Maize is known as corn, belongs to the family *Poaceae*. It was originated in Mexico. Even if the total production of maize is more, little of maize is consumed directly by humans as most of it is used for production of corn ethanol, animal feed and other maize products such as corn starch and corn syrup. Maize has spread to the rest of the world because of its ability to grow in diverse climatic conditions, immense potentiality and nutritive value. Maize is highly rich in starch, 71 to 72 per cent and it has a protein content of 9 to 10 percent, fat (4 to 45 percent), fibre (9 to 10 percent) and sugar (2 to 3 percent). Maize is also known as 'Queen of cereals'.

The United States produces more than 35 percent of world's maize. Other top maize producing countries are China, Brazil, Mexico, Argentina and India. The world maize production during 2017-18 is 1,134 million tonnes. In India, total maize production in 2017-18 was 25 million tonnes in a sown area of 95 lakh hectares. In Karnataka, maize production is 5.4 million tonnes. About 2 percent of the total maize is being produced in India, and Karnataka is in top position accounting for about 16 percent of total maize production in India. Among maize growing states Karnataka followed by Telangana, Bihar, Maharashtra are the top producers. In India about 71 per cent of maize crop is grown in *Kharif* (Anon., 2017) <sup>[1]</sup>.

Maize is a C<sub>4</sub> plant it has got greater yield potential as compared to other cereals. However insect infestation at different stages of crop from sowing to maturity poses a serious limitation in getting the expected yield. The multiple pest complex of maize crop poses serious limitations in the maize cultivation in different agro climatic regions of India. Siddiqui and Marwaha (1994) <sup>[7]</sup> reported that, out of all the pests causing varying degree of damage to maize crop, only a dozen are quite serious and they need to be controlled.

Among all the pests that attack maize, *Chilo partellus* (swinhoe), *Sesamia inferens* and *Atherigona soccata* are of major importance during different seasons in India (Kumar *et al.* 2005) <sup>[3]</sup>. The other pests like Bihar hairy caterpillar, aphids, leafhoppers, white backed plant hoppers, semilooper etc. also attack this crop. A new insecticide class, the anthranilic diamides, includes products that are long lasting, mainly against Lepidoptera and have safe

environmental profile than previous ones Hannig *et al.* (2009), Lai and Su (2011) [2, 4]. This class of chemical has not been extensively tested against *Helicoverpa zea* under field but lack of damage control using pyrethroid insecticides makes evaluation of Chlorantraniliprole as a spray treatment in controlling the insect damage Shelton *et al.* (2013) [6].

The fall armyworm (*Spodoptera frugiperda*), a species belongs to the order of Lepidoptera. *Spodoptera frugiperda* is widely distributed in Eastern and Central North America and in South America. *Spodoptera frugiperda* was first reported in Africa, where it has caused significant damage to the maize crop and in 2018 it has been spotted in Southern India. Remarkable trait of this larva is that, they practice cannibalism. It is regarded as a pest and can damage a wide range of crops, which causes large economic losses. Because of its ability to cause immense destruction, possible crop protection measures is being studied in depth.

There is considerable increase of pest infestation on maize in the recent years, which in turn is affecting the seed yield and quality of maize causing huge losses to the farmers. Keeping this in view, the effect of new insecticide molecule on quality attributes in maize is studied during Rabi, 2018.

### Material and Methods

The study on effect of new insecticide molecule on seed quality attributes in maize inbred line CAL-1443 was studied at NSP, UAS, GKVK, Bengaluru. Sowing was taken up in the month of October, with seed treatment at different concentrations prior to sowing and spraying of different chemicals was carried out at 45 days after sowing. The experimental site is situated between 12° 15' N latitude and 77° 35' E longitude at an altitude of about of about 930 m above Mean sea level. The experiment was laid out in randomized complete block design and replicated in three times with ten treatments, T<sub>1</sub>- Chlorantraniliprole 0.1 ml / kg (ST), T<sub>2</sub>- Chlorantraniliprole 0.2 ml / kg (ST), T<sub>3</sub>- Chlorantraniliprole 0.3 ml / kg (ST), T<sub>4</sub>- Chlorantraniliprole 0.1 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS, T<sub>5</sub>- Chlorantraniliprole 0.2 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS, T<sub>6</sub>- Chlorantraniliprole 0.3 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS, T<sub>7</sub>- Chlorantraniliprole 0.1 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS, T<sub>8</sub>- Chlorantraniliprole 0.2 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS, T<sub>9</sub>- Chlorantraniliprole 0.3 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS, T<sub>10</sub>- Control. Five tagged plants were used for getting results on seed quality parameters in maize.

### Results and Discussion

The insect infestation and seed quality parameters of maize viz., seed germination percentage, mean seedling length, mean seedling dry weight, seedling vigour index I seedling vigour index II and TD. Has influenced by seed treatment followed by spray are presented in Table 1.

### Insect infestation percentage at 60 DAS and at harvest

Significant difference was observed among the treatments. The least percent leaves damage at 60 DAS (7.37 %) was recorded in T<sub>9</sub> which is followed by T<sub>6</sub> (9.73 %). While, highest (23.40 %) was recorded in untreated control T<sub>10</sub>. The least (5.70 %) percent leaves damage at harvest was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (6.40 %). Whereas, the highest (9.00 %) was observed in untreated control T<sub>10</sub>.

Insect infestation differed significantly among the treatments and the probable reason may be because the new insecticide molecule chlorantraniliprole belong to a group of anthranilamide having a unique mode of action in muscle disruption and has been found effective against many lepidopteron insect pests. Thus this chemical at higher concentration was able to reduce the pest damage in the form of leaf injury level and dead heart incidence and gave more protection. These results are in agreement with Ravinder and Jawala (2015) [5] in maize.

### Seed germination (%)

Seed germination percentage did not differ significantly among the treatments. Highest seed germination percentage (93.00 %) was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (92.33 %), T<sub>3</sub> (92.33 %) Whereas the lowest (90.33 %) was observed in untreated control T<sub>10</sub>.

### Mean seedling length (cm)

There was no significant difference observed in the mean seedling length among the treatments. Highest (33.65 cm) mean seedling length was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (33.18 cm) whereas the lowest (31.91 cm) was observed in T<sub>10</sub>.

### Mean seedling dry weight (mg)

The mean seedling dry weight did not differed significantly due to treatments. The highest (56.10 mg) mean seedling dry weight was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (56.07 mg) whereas the lowest (55.41 mg) was observed in T<sub>10</sub>.

### Seedling vigour index –I

There was non-significant difference observed in the seedling vigour index – I among the treatments. Highest seedling vigour index –I (3103) was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (3067) whereas the lowest Seedling vigour index – I (2914) was observed in (T<sub>10</sub>).

### Seedling vigour index –II

There was no significant difference observed in the seedling vigour index II due to treatments. Highest seedling vigour index – II (5216) was observed in T<sub>9</sub> which is on par with T<sub>6</sub> (5177) whereas the lowest Seedling vigour index –II (5005.06) was observed in (T<sub>10</sub>).

### Total dehydrogenase activity (A<sub>480nm</sub>)

There was no significant difference observed in the total dehydrogenase activity among the treatments. Highest total dehydrogenase activity (1.36) was observed in T<sub>9</sub> which is on par with T<sub>6</sub>, T<sub>8</sub>, T<sub>5</sub>, T<sub>3</sub> and T<sub>2</sub> (1.35). Whereas, the lowest (1.33) was observed in untreated control T<sub>10</sub>.

**Table 1:** Influence of new insecticide molecule on insect management and seed quality parameters in maize

Treatments	Insect infestation (%)		Seed germination (%)	Mean seedling length (cm)	Mean seedling dry weight (mg)
	60 DAS	At harvest			
T <sub>1</sub> : Chlorantraniliprole 0.1 ml / kg (ST)	19.33	8.63	91.33	31.96	55.53
T <sub>2</sub> : Chlorantraniliprole 0.2 ml / kg (ST)	16.87	8.20	91.67	32.22	55.77
T <sub>3</sub> : Chlorantraniliprole 0.3 ml / kg (ST)	11.10	6.77	92.33	33.07	56.01
T <sub>4</sub> : Chlorantraniliprole 0.1 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS	17.97	8.20	91.33	32.05	55.13
T <sub>5</sub> : Chlorantraniliprole 0.2 ml / kg (ST) and spray with	15.50	7.10	91.33	32.65	55.73

chlorpyrifos 2 ml at 45 DAS					
T <sub>6</sub> : Chlorantraniliprole 0.3 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS	9.73	6.40	92.33	33.18	56.07
T <sub>7</sub> : Chlorantraniliprole 0.1 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	17.57	7.90	91.00	32.03	55.60
T <sub>8</sub> : Chlorantraniliprole 0.2 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	13.80	6.80	91.67	32.62	55.90
T <sub>9</sub> : Chlorantraniliprole 0.3 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	7.37	5.70	93.00	33.65	56.10
T <sub>10</sub> : Control	23.40	9.00	90.33	31.91	55.41
S.Em±	1.08	0.76	1.027	0.603	0.333
CD (P=0.05)	3.20	NS	NS	NS	NS
CV (%)	12.21	17.66	1.94	3.20	1.03

**Table 2:** Shows Treatments Seedling vigour index I Seedling vigour index II and Total dehydrogenase activity (A480nm)

Treatments	Seedling vigour index I	Seedling vigour index II	Total dehydrogenase activity (A <sub>480nm</sub> )
T <sub>1</sub> : Chlorantraniliprole 0.1 ml / kg (ST)	2970	5072	1.34
T <sub>2</sub> : Chlorantraniliprole 0.2 ml / kg (ST)	2997	5110	1.35
T <sub>3</sub> : Chlorantraniliprole 0.3 ml / kg (ST)	3049	5172	1.35
T <sub>4</sub> : Chlorantraniliprole 0.1 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS	2968	5035	1.34
T <sub>5</sub> : Chlorantraniliprole 0.2 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS	2990	5090	1.35
T <sub>6</sub> : Chlorantraniliprole 0.3 ml / kg (ST) and spray with chlorpyrifos 2 ml at 45 DAS	3067	5177	1.35
T <sub>7</sub> : Chlorantraniliprole 0.1 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	2976	5059	1.34
T <sub>8</sub> : Chlorantraniliprole 0.2 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	3007	5123	1.35
T <sub>9</sub> : Chlorantraniliprole 0.3 ml / kg (ST) and spray with quinolphos 2 ml at 45 DAS	3103	5216	1.36
T <sub>10</sub> : Control	2914	5005	1.33
S.Em±	55.4	66.5	0.005
CD (P=0.05)	NS	NS	NS
CV (%)	3.19	2.26	0.70

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