IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
ISSN-0973-1547 Volume 17 | Issue 2 | July, 2022 | 146-150
DOI: 10.15740/HAS/IJPS/17.2/146-150
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RESEARCH ARTICLE

# Assessment of solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) as phtotoxixity and effects on natural enimies of sucking insect pests in kinnow plants

■ **Harjindra Singh and Roop Singh Meena**

## SUMMARY

The trial for study was on orchard of Agricultural Research Station Srigangangar of kinnow 2 trees per treatment/ replication during 2016-2017. Eight treatments including control were evaluated and each treatment was replicated three times and using RBD to work bio-effeciacy of natural enemies of sucking insect pests of kinnow. Observations in each plot separately on natural enemies' population were also recorded one days before of spray and 3, 7, 10 and 14 days after spray and evaluated from pooled data the natural enemies population has reduced some extend 3rd after spray and again increased also no ill effect of the natural enemies' population. Out of these treatments two treatments one using 7 ml/ha and 14 ml/hawas taken as phyto-toxicity observation. No phyto toxicity symptoms was observed on number of leaves and infested leaves per twigs from 5 randomly selected twigs by viewing symptoms like leaf injury, yellowing, stunting, necrosis, epinasty and hyponasty in the leafs.

**Key Words :** Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD), Phtotoxixity, Natural enimies, Sucking insect pests, kinnow plants

**How to cite this article :** Singh, Harjindra and Meena, Roop Singh (2022). Assessment of solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) as phtotoxixity and effects on natural enimies of sucking insect pests in kinnow plants. *Internat. J. Plant Sci.*, **17** (2): 146-150, **DOI: 10.15740/HAS/IJPS/17.2/146-150,** Copyright@ 2022:Hind Agri-Horticultural Society.

**Article chronicle : Received :** 21.03.2022; **Revised :** 19.04.2022; **Accepted :** 21.05.2022

The crops and fruits are infested by different insect-pests. There is presence of their natural enemies along with insect pests on the crops or it may be controlled by using pathogens, Predators, spiders and parasitoids. The combination of chemical and biological control is often critical to the success of an integrated pest management (IPM) programme for arthropod pests (Smilanick *et al.,*1996; El-Wakeil and Vidal, 2005; El-Wakeil *et al.,* 2006 and Volkmar *et al.,* 2008). Such kinnow plants have infestation of sucking insect pests along with natural enemies. The present study was done on kinnow plants. Kinnow is cultivated in Northern India and even in other citrus growing states because adaption to the agro-ecological conditions in Sri-ganganagar

MEMBERS OF THE RESEARCH FORUM

**Author to be contacted :**
**Harjindra Singh,** Krishi Vigyan Kendra, Padampur, **Srigangangar (Rajasthan) India**
**Email** : jindra.ento@gmail.com

**Address of the Co-authors:**
**Roop Singh Meena and Pradeep Kumar,** Agricultural Research Station, **Srigangangar (Rajasthan) India**

(Rajasthan) India. It belongs to family Rutaceae and sub-family Aurantioedae which was developed through hybridization between King mandarin x Willow leaf orange by H.B. Frost in 1915 and released in 1935 was introduced by Dr. J.C. Bakhshi at Abohar research station in 1954. The area under kinnow cultivation in India is about nearby 67 thousand hectares which produce 412 thousand Metric ton (2018-19). Kinnow contribute 6.23 per cent share of India only from Sriganganagar and Hanumangarh district of Rajasthan where its cultivate on area of 16, 575h. It has rich source of vitamins and have highly nutritional value. Indian council of medical Research has recommended balance diet. That should be 85 g of fruits per capita per day. The kinnow is infested by several sucking insect pests along with their natural enemies and using insecticides there may be phyto-toxicity on the plants. Therefore, study on the side effect of Solomon 300 OD on the natural enemies is highly required to calculate detrimental effects on the natural enemies. By thinking this point of view the present studies "effect of Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) on natural enemies' population and its phyto- toxic effect were taken"

## MATERIAL AND METHODS

The study was conducted on kinnow 2 trees per treatment/ replicationat Kinnow orchard of Agricultural Research Station, Sriganganagar during 2016 and 2017.

**Effect on non-target organisms:**

Eight treatments including control were evaluated and each treatment was replicated three times and using RBD. All the agronomic practices were followed as per the recommended package of practices. Observations in each plot separately on natural enemies population were also recorded one days before of spray and 3, 7, 10 and 14 days after spray to work out effect on natural enemies along with sucking insect pest complex of kinnow. The data obtained from field experiments in a Randomized Block Design were statistically analyzed after converting it into suitable transformed values.

**Pyhtotoxicity :**

Forphyto-toxicity study three treatments including control were evaluated and each treatment was replicated three times and using RBD. All the agronomic practices were followed as per the recommended package of practices. The phyto-toxicity observations at 0, 3, 7, 10 and 15 days after each spraying were recorded with two doses of this combination of Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) @ 7.0 ml/10 lit. of water with its two-time higher dose 14.0 ml/10 lit. of water and one control treatment were used for phyto-toxicity study

**Table A : Phytotoxicity**

| Sr. No. | Treatments | a.i. (g) | Formulation (ml/ha) |
|---|---|---|---|
| 1. | Control | - | - |
| 2. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 0.63+1.47 | 7.00 |
| 3. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 1.26+2.94 | 14.00 |

Observed data like the symptoms - Leaf injury, yellowing, stunting, necrosis, epinasty and hyponastyin the leafs. The recorded data is classified as following 1-10 scale as under.

**Table B: Rating scale for phyto-toxicity**

| Crop response/crop injury | Grade | Crop response/crop injury | Grade |
|---|---|---|---|
| 0-0% | 0 | 51-60% | 6 |
| 1-10% | 1 | 61-70% | 7 |
| 11-20% | 2 | 71-80% | 8 |
| 21-30% | 3 | 81-90% | 9 |
| 31-40% | 4 | 91-100% | 10 |
| 41-50% | 5 | | |

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

**Effect on non-target organisms:**

Two species of predators namely, spiders, syrphid-fly and coccinelidappeared on the crop. It is evident from the pooled data (Table 1a, b and c) that, the natural enemies population has reduced some extend 3rd after spray and again increased. Hence, there is no ill effect of the treatments under trial on the natural enemies' population. At most Similarly data also reported by other researcher.

**Phytotoxicity :**

The data on phyto toxicity regarding phytotoxic

**Table: 1a : Effect of solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) natural enemies (Mean of two Sprays)**

| Sr. No. | Treatments | Dose (ml/10 lit. water) | Spider/plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2016 | | | | | 2017 | | | | |
| | | | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS |
| 1. | Control | - | 3.67 (2.04*) | 4.17 (2.16*) | 4.33 (2.20*) | 4.67 (2.27*) | 5.67 (2.48*) | 4.17 (2.16*) | 4.67 (2.27*) | 4.33 (2.20*) | 5.00 (2.35*) | 5.33 (2.41*) |
| 2. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 3.00 | 4.67 (2.27) | 3.33 (1.96) | 3.67 (2.04) | 4.00 (2.12) | 4.67 (2.27) | 4.67 (2.27) | 3.00 (1.87) | 3.33 (1.96) | 4.00 (2.12) | 4.67 (2.27) |
| 3. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 5.00 | 5.33 (2.41) | 3.67 (2.04) | 4.00 (2.12) | 4.67 (2.27) | 5.17 (2.38) | 4.33 (2.20) | 2.67 (1.78) | 3.00 (1.87) | 3.33 (1.96) | 5.17 (2.38) |
| 4. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 7.00 | 4.17 (2.16) | 2.33 (1.68) | 2.67 (1.78) | 3.33 (1.96) | 4.00 (2.12) | 4.67 (2.27) | 3.00 (1.87) | 3.33 (1.96) | 3.67 (2.04) | 4.00 (2.12) |
| 5. | Betacyfluthrin 25 SC (Betacyfluthrin 2.45% w/w SC) | 25.50 | 5.00 (2.35) | 3.17 (1.92) | 3.67 (2.04) | 4.33 (2.20) | 5.33 (2.41) | 4.00 (2.12) | 3.00 (1.87) | 3.17 (1.92) | 3.33 (1.96) | 5.33 (2.41) |
| 6. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 7.50 | 5.17 (2.38) | 3.00 (1.87) | 4.33 (2.20) | 4.33 (2.20) | 5.00 (2.35) | 5.00 (2.35) | 3.67 (2.04) | 3.67 (2.04) | 4.00 (2.12) | 5.00 (2.35) |
| 7. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 5.00 | 4.33 (2.20) | 2.67 (1.78) | 3.33 (1.96) | 4.00 (2.12) | 4.67 (2.27) | 5.33 (2.41) | 4.00 (2.12) | 4.17 (2.16) | 4.33 (2.20) | 4.67 (2.27) |
| 8. | Quinalphos 25 % EC | 28.00 | 4.00 (2.12) | 3.17 (1.92) | 3.33 (1.96) | 4.17 (2.16) | 4.33 (2.20) | 4.67 (2.27) | 3.67 (2.04) | 4.00 (2.12) | 4.33 (2.20) | 4.67 (2.27) |
| | C.D. (P=0.05) | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*Figures in parentheses are square rootvalues; B.S.- Before spray; DAS – Days after spray

**Table 1b : Effect of solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD)natural enemies(Mean of two Sprays)**

| Sr. No. | Treatments | Dose (ml/10 lit. water) | Coccinelid/plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2016 | | | | | 2017 | | | | |
| | | | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS |
| 1. | Control | - | 2.17 (1.63*) | 2.33 (1.68*) | 2.67 (1.78*) | 3.17 (1.92*) | 3.33 (1.96*) | 1.67 (1.47*) | 2.00 (1.58*) | 2.17 (1.63*) | 2.33 (1.68*) | 3.33 (1.96*) |
| 2. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 3.00 | 1.67 (1.47) | 1.00 (1.22) | 1.33 (1.35) | 1.67 (1.47) | 2.17 (1.63) | 2.00 (1.58) | 1.33 (1.35) | 1.67 (1.47) | 1.67 (1.47) | 2.17 (1.63) |
| 3. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 5.00 | 2.67 (1.78) | 1.67 (1.47) | 2.17 (1.63) | 2.33 (1.68) | 3.00 (1.87) | 2.33 (1.68) | 1.33 (1.35) | 1.67 (1.47) | 2.00 (1.58) | 2.67 (1.78) |
| 4. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 7.00 | 3.00 (1.87) | 1.33 (1.35) | 2.00 (1.58) | 2.67 (1.78) | 3.17 (1.92) | 2.67 (1.78) | 1.17 (1.29) | 1.33 (1.35) | 2.33 (1.68) | 3.00 (1.87) |
| 5. | Betacyfluthrin 25 SC (Betacyfluthrin 2.45% w/w SC) | 25.50 | 2.33 (1.68) | 1.33 (1.35) | 1.67 (1.47) | 2.00 (1.58) | 2.67 (1.78) | 2.17 (1.63) | 1.33 (1.35) | 1.67 (1.47) | 2.17 (1.63) | 2.33 (1.68) |
| 6. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 7.50 | 2.00 (1.58) | 1.00 (1.22) | 1.33 (1.35) | 1.67 (1.47) | 2.33 (1.68) | 2.00 (1.58) | 1.17 (1.29) | 1.33 (1.35) | 1.67 (1.47) | 2.17 (1.63) |
| 7. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 5.00 | 2.67 (1.78) | 2.00 (1.58) | 2.33 (1.68) | 2.67 (1.78) | 3.17 (1.92) | 2.33 (1.68) | 1.67 (1.47) | 2.00 (1.58) | 2.17 (1.63) | 2.67 (1.78) |
| 8. | Quinalphos 25 % EC | 28.00 | 2.33 (1.68) | 1.67 (1.47) | 1.67 (1.47) | 2.33 (1.68) | 2.67 (1.78) | 2.67 (1.78) | 1.33 (1.35) | 1.67 (1.47) | 2.33 (1.68) | 3.17 (1.92) |
| | C.D. (P=0.05) | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*Figures in parentheses are Square root values; B.S.- Before spray; DAS – Days after spray NS= Non-significant

**Table: 1c : Effect of solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) natural enemies (Mean of two sprays)**

| Sr. No. | Treatments | Dose (ml/10 lit. water) | Syrphid fly/plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2016 | | | | | 2017 | | | | |
| | | | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS | B.S. | 3 DAS | 7 DAS | 10 DAS | 14 DAS |
| 1. | Control | - | 1.17 (1.29*) | 1.33 (1.35*) | 1.67 (1.47*) | 1.67 (1.47*) | 2.33 (1.68*) | 1.00 (1.22*) | 1.17 (1.29*) | 1.33 (1.35*) | 1.67 (1.47*) | 1.67 (1.47*) |
| 2. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 3.00 | 1.67 (1.47) | 1.00 (1.22) | 1.33 (1.35) | 1.67 (1.47) | 2.00 (1.58) | 1.17 (1.29) | 0.67 (1.08) | 1.00 (1.22) | 1.33 (1.35) | 1.33 (1.35) |
| 3. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 5.00 | 1.17 (1.29) | 0.33 (0.91) | 1.00 (1.22) | 1.33 (1.35) | 1.67 (1.47) | 1.33 (1.35) | 0.67 (1.08) | 1.00 (1.22) | 1.17 (1.29) | 1.33 (1.35) |
| 4. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 7.00 | 1.00 (1.22) | 0.00 (0.71) | 0.67 (1.08) | 1.00 (1.22) | 1.33 (1.35) | 0.67 (1.08) | 0.00 (0.71) | 0.33 (0.91) | 0.67 (1.08) | 1.00 (1.22) |
| 5. | Betacyfluthrin 25 SC (Betacyfluthrin 2.45% w/w SC) | 25.50 | 0.67 (1.08) | 0.00 (0.71) | 0.33 (0.91) | 1.17 (1.29) | 1.33 (1.35) | 1.00 (1.22) | 0.33 (0.91) | 0.67 (1.08) | 1.00 (1.22) | 1.17 (1.29) |
| 6. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 7.50 | 1.67 (1.47) | 0.67 (1.08) | 1.17 (1.29) | 1.67 (1.47) | 2.00 (1.58) | 1.33 (1.35) | 0.67 (1.08) | 1.00 (1.22) | 1.17 (1.29) | 1.67 (1.47) |
| 7. | Imidacloprid 200 SL (imidacloprid 17.8% w/w SL) | 5.00 | 1.17 (1.29) | 0.00 (0.71) | 0.67 (1.08) | 1.33 (1.35) | 1.67 (1.47) | 1.17 (1.29) | 0.67 (1.08) | 1.00 (1.22) | 1.00 (1.22) | 1.33 91.35) |
| 8. | Quinalphos 25 % EC | 28.00 | 1.33 (1.35) | 0.33 (0.91) | 0.67 (1.08) | 1.17 (1.29) | 1.67 (1.47) | 1.00 (1.22) | 0.33 (0.91) | 0.67 (1.08) | 0.67 (1.08) | 1.00 91.22) |
| | C.D. (P=0.05) | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*Figures in parentheses are square root values; B.S.- Before spray; DAS – Days after spray NS= Non- significant

**Table 2 : Evaluation of phytotoxicity due to spraying of Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD)on Citrus during2016 and 2017**

| Sr. No. | Treatments | Dose (ml/10 lit.) | Phytotoxicity (%) | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yellowing | | | | | Stunting | | | | | Necrosis | | | | | Epinasty | | | | | Hyponasty | | | | |
| | | | B.S. | 3 | 7 | 10 | 15 | B.S. | 3 | 7 | 10 | 15 | B.S. | 3 | 7 | 10 | 15 | B.S. | 3 | 7 | 10 | 15 | B.S. | 3 | 7 | 10 | 15 |
| 1. | Control | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 7.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3. | Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) | 14.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Scale (0-10): 0=00, 1= 1-10%, 2= 11-20%, 3= 21-30%, 4=31-40%, 5=41-50%, 6=51-60%, 7=61-70%, 8=71-80%, 9= 81-90%, 10= 91-100

effects such as leaf injury, yellowing, stunting, necrosis, epinasty and hyponasty was recorded before, 3, 7, 10 and 14 days after spraying revealed that solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) even at its higher dose (*i.e.* 14.0 ml/litter of water) did not show any phytotoxicity on kinnow (Table 2) about similarly data also reported by other researcher on different insecticides like Visnupriya *et al*. (2017) revealed that spinetoram 12 SC 36, 45, 54 g a.i/ha and even two times higher than normal dose (108 g a.i./ha) did not show any phytotoxic symptoms like injury to leaf tip and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty on okra, brinjal and tomato.

## Conclusion:

This study revealed that phyto-toxicity data on Solomon 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD)@ 3.0, 5.0 and 7.0 ml/ha were found best on natural enemies population. The product was found to be safe to crop and no phyto-toxicity symptoms were recorded in recommended treatments and even in higher doses. The present findings indicated that even higher dose of solomom 300 OD (Betacyfluthrin 90 + Imidacloprid 210 OD) @ 5.0 ml/ 10 litter of water) had not phyto-toxic effect on kinnow plants when applied against sucking insect pests and be safe to their natural enemies.

## Acknowledgement:

The authors acknowledge ARS, Sri-ganganagar forplanting experimental trail for two consecutive years and helpful Dr. Roop Singh Meena (PI of trail) and Dr. Pradeepkumar (Co-PI) and I also help that time with PI and also preparation of the research paper.

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