Effect of Some Wheat Cultivars and Control Treatments on Reducing the Population Density of Wheat Thrips, *Haplothrips leucanthemi*

Maysoon A. Abdul Husain [1]*, Awad J. Muhammed Alkalash[2]
awad_jasim@tu.ed.iq
Tikrit University, College of Agriculture, Department of Plant Protection, Iraq

Abstract

The study was carried out to evaluate the effectiveness of wheat cultivars in reducing the density of wheat thrips, *Haplothrips leucanthemi* in the field. A factorial experiment was conducted using a randomized complete block design, with three replications, during the 2024-2025 season. Three wheat cultivars (Abaa 99, Buhuth 22 and Boro) and eight control treatments were tested: Sivanto, imidacloprid, potassium silicate, Sivanto + potassium silicate, imidacloprid + potassium silicate, Sivanto + imidacloprid, Sivanto + imidacloprid + potassium silicate, and untreated control. Thrips were counted before treatment and 1, 7, 14, 21 and 30 days after treatment. There was not a significant difference in the initial infestation between treatments. The treatment of Sivanto + imidacloprid + potassium silicate had the lowest means for all assessment dates after application, followed mainly by Sivanto + potassium silicate. Abaa 99 had the least thrips population while the highest infestation level was present in Boro. Based on the results, cultivar responses and effective control measures can be combined to enhance the management of wheat thrips.

Keywords: Wheat; Thrips; *Haplothrips leucanthemi*; Sivanto; imidacloprid; potassium silicate.

Introduction

Cultivation of wheat (*Triticum aestivum* L.) is one of the most significant cereal productions in the world and it serves as an essential source of plant protein and energy and main food security. The strategic value of wheat in Iraq is very high because of its direct connection to the national food supply and the self-sufficiency policy. However, wheat is susceptible to several insect pests that will impact its vegetative vigour, spike formation and grain filling, such as thrips.

The thrips are unique in being small and hidden within leaves or spikes, rather than being visible on the leaf surface, and thus are less readily monitored and controlled than many other visible pests. Thrips are known to be difficult pests to control due to their complex life cycle and ability to become resistant to insecticides [1]. In addition, Abdillayev and Bababekov [2]

suggested that wheat thrips can be found at different densities in fields and cause damage from the vegetative growth stage to maturity, while Zhichkina et al. [3] noted that in untreated fields grain thrips damage can be significant. The genus *Haplothrips* includes several closely related species associated with cereals and wild flowering plants, and their taxonomic relationships have been revised in recent studies [11, 12].

Wheat thrips are generally controlled using chemicals when densities reach levels where control is needed; insecticide use alone is not a viable long-term approach as there is a risk that the insect will become resistant and that natural enemies will be affected [15, 16]. According to Nauen et al. [4], the active ingredient of Sivanto, flupyradifurone, is a modern insecticide of the butenolide group with a quick activity against piercing sucking pests. In addition, some studies have indicated that insecticide use in an IPM program may enhance thrips control [5]. Imidacloprid, the first commercial neonicotinoid, is a systemic insecticide that acts as an agonist of the insect nicotinic acetylcholine receptors and is widely used against sucking insect pests, including thrips, as foliar, soil and seed treatments [13, 14]. On the other hand, [6, 7] demonstrated that potassium silicate has gained attention for its natural ability to enhance plant resistance to insects by physical barrier and chemical and biological defensive responses [17, 18].

Physiological differences in susceptibility to wheat thrips infestation among wheat cultivars may warrant the use of cultivars with effective control treatments as a practical basis for the integrated management of wheat thrips. In this regard, the present study was conducted to determine the effect of three wheat cultivars and eight control treatments for reducing wheat thrips (*Haplothrips leucanthemi*) population density under field conditions.

Materials and Methods

Study Site and Experimental Design

The field experiment took place at the Research Station of the Department of Plant Protection of the University of Tikrit - College of Agriculture, during the growing season 2024-2025. The factorial experiment with a randomized complete block design (RCBD) was used, replicated three times. It included two factors: the first factor consisted of control treatments, and the second factor involved different wheat cultivars. Hence, there were a total 72 experimental units (8 treatments × 3 cultivars × 3 replications). Each experimental unit in the experiment was 2 m by 2 m. Seeds were planted in rows on 15/11/2024 and the normal farming operations were undertaken till the end of the season, which included tillage, leveling, seeding, fertilizing, irrigation and weeding.

Cultivars and Control Treatments

Three wheat cultivars were used in the experiment: Boro, Abaa 99 and Buhuth

22. The control treatments included: Sivanto, imidacloprid, potassium silicate, Sivanto + potassium silicate, imidacloprid + potassium silicate, Sivanto + imidacloprid, Sivanto + imidacloprid + potassium silicate, and untreated control. Sivanto was applied using a foliar spray at a rate of 70 ml/100 L water, imidacloprid was applied at 1.5 L/ha and potassium silicate was applied as a foliar spray at 3 ml/100 L water.

Assessment of Wheat Thrips Population

Wheat thrips, Haplothrips leucanthemi, were counted live on five spikes of each experimental unit using a 10× hand lens to determine their population density. Counting was performed one day prior to the application of the treatment and 1, 7, 14, 21 and 30 days after spraying.

Statistical Analysis

The data have been analyzed using analysis of variance (ANOVA) with the appropriate design and GenStat computer program has been used for analysis. Least significant difference (LSD) test at 0.05 probability level was used to compare means.

Results and Discussion

Infestation One Day Before Treatment

The mean number of wheat thrips (*Haplothrips leucanthemi*) collected one day before the application of the treatment is shown in Table 1. It can be seen in the table that the spray means were relatively similar at the initial infestation with the means of the spray treatments ranging from 47.800 individuals for the potassium silicate treatment to 48.333 individuals for the treatment of Sivanto + potassium silicate, with the untreated control mean being 48.167 individuals. The closeness reflects the homogeneity of the initial pest density at the time of treatment application, thus enhancing the validity of the comparison of the initial pest density between treatments. The difference between the cultivars was also evident in the physiological aspect, as the Boro cultivar yielded the highest mean of 56.217 individuals while Abaa 99 cultivar yielded the lowest individual mean of 40.350 individuals were observed. Regarding the interaction between treatments and cultivars (LSD 0.05 = 0.3322), the means ranged from 40.000 individuals for potassium silicate on Abaa 99 to 56.467 individuals for Sivanto + imidacloprid + potassium silicate on Boro, and the treatment means within each cultivar were very close, indicating that the variation in the initial infestation was mainly due to the cultivar.

Table 1. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, one day before treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	40.200	47.700	56.300	48.067
Imidacloprid	40.500	47.300	56.067	47.956
Potassium silicate	40.000	47.500	55.900	47.800
Sivanto + potassium silicate	40.400	48.200	56.400	48.333
Imidacloprid + potassium silicate	40.600	47.733	56.000	48.111
Sivanto + imidacloprid	40.367	47.800	56.367	48.178
Sivanto + imidacloprid + potassium silicate	40.433	47.967	56.467	48.289
Untreated control	40.300	47.967	56.233	48.167
Cultivar Mean	**40.350**	**47.771**	**56.217**	**48.112**
LSD 0.05	**Treatments = 0.1918 Cultivars = 0.1174 Interaction = 0.3322**			

The results were in agreement with the earlier scientific studies which suggested that the grain thrips infestation level and damage did not correspond to the presence of the pest only; cultivar, environmental conditions and growth stages of the plants were also involved in the infestation level and damage [2, 3]. The findings also agree with the findings of. [9] and [10] on the importance of cultivar related resistance/susceptibility in the control of wheat pests.

Infestation One Day After Treatment

The mean number of thrips one day after application of the treatments is indicated in Table 2. The treatments with insecticide reduced the numbers of insects significantly, compared to the untreated control. The treatment consisting of Sivanto + imidacloprid + potassium silicate had the lowest mean of 13.233 individuals, followed by the treatment with Sivanto + potassium silicate, a mean of 15.374 individuals, and the treatment with Sivanto + imidacloprid, 15.533 individuals. Potassium silicate achieved 39.667 individuals with no indication of the effect it had in the first 24 h compared with the chemical treatments. Regarding the cultivars, Abaa 99 had the lowest mean (19.184 individuals), followed by Buhuth 22 (23.103 individuals), whereas Boro had the highest mean (27.172 individuals), and the differences among the three cultivars exceeded the LSD value (0.2053). For the interaction between treatments and cultivars (LSD 0.05 = 0.5807), the lowest number was recorded for Sivanto + imidacloprid + potassium silicate on Abaa 99 (10.200 individuals), while the highest was recorded for the untreated control on Boro (55.300 individuals).

Table 2. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, one day after treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	13.267	16.800	20.400	16.822
Imidacloprid	15.603	18.483	22.210	18.766
Potassium silicate	34.400	39.900	44.700	39.667
Sivanto + potassium silicate	12.000	15.323	18.800	15.374
Imidacloprid + potassium silicate	14.203	17.420	20.970	17.531
Sivanto + imidacloprid	12.300	15.500	18.800	15.533
Sivanto + imidacloprid + potassium silicate	10.200	13.300	16.200	13.233
Untreated control	41.500	48.100	55.300	48.300
Cultivar Mean	**19.184**	**23.103**	**27.172**	**23.153**
LSD 0.05	**Treatments = 0.3353 Cultivars = 0.2053 Interaction = 0.5807**			

The results agree with those described by [4] that flupyradifurone acts rapidly on piercing-sucking pests, it acts on nicotinic acetylcholine receptors and it is translocated in the plant. They also agree with the results of [5] who demonstrated the efficacy of flupyradifurone and several neonicotinoid insecticides in thrips control in integrated control programs. It is important that potassium silicate alone is effective only for the first day. This is not a fundamental change in the mode of action compared to earlier research as silicon typically does not have a knockdown effect on insect pests, but rather a long-term activation of plant defense mechanisms [6, 7].

Infestation 7 Days After Treatment

Table 3 shows that the efficacy of the treatments became more evident 7 days after treatment. There were 3.100 mean individuals after applying Sivanto + imidacloprid + potassium silicate, followed by the Sivanto + imidacloprid treatment with a mean of 4.789 individuals and the Sivanto + potassium silicate treatment with a mean of 4.949 individuals. The untreated control plot had a higher number of thrips, reaching 76.910 individuals. This indicates that the first week after spraying represents an important stage for the appearance of maximum efficacy of the Sivanto-containing treatments. Regarding the cultivars, Abaa 99 had the lowest mean (14.693 individuals), followed by Buhuth 22 (17.001 individuals) and Boro (19.667 individuals), and the differences among the cultivars exceeded the LSD value (0.4473). For the interaction between treatments and cultivars (LSD 0.05 = 1.2651), Sivanto + imidacloprid + potassium silicate on Abaa 99 recorded the lowest number

(2.233 individuals), which did not differ from the same treatment on Buhuth 22 (3.100 individuals), while the untreated control on Boro recorded the highest number (84.907 individuals).

Table 3. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, 7 days after treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	4.410	5.803	7.090	5.768
Imidacloprid	6.903	8.483	10.207	8.531
Potassium silicate	21.533	25.587	30.293	25.804
Sivanto + potassium silicate	3.723	4.930	6.193	4.949
Imidacloprid + potassium silicate	5.507	7.117	8.713	7.112
Sivanto + imidacloprid	3.700	4.700	5.967	4.789
Sivanto + imidacloprid + potassium silicate	2.233	3.100	3.967	3.100
Untreated control	69.533	76.290	84.907	76.910
Cultivar Mean	**14.693**	**17.001**	**19.667**	**17.120**
LSD 0.05	**Treatments = 0.7304 Cultivars = 0.4473 Interaction = 1.2651**			

The findings in this study were similar to previous scientific investigations, which proved the need for using effective insecticides to suppress thrips population in a short time after application [5]. These results for Sivanto in combination with potassium silicate are also in line with the results presented by. [8] who reported that silicon application in wheat resulted in a higher content of lignin, phenols and flavonoids and activated defensive enzymes, which in turn led to a decrease in piercing-sucking pests. The dramatic rise in the untreated control is similar to that reported by [2] and. [3] for the capacity of grain thrips to attain high densities in untreated fields.

Infestation 14 Days After Treatment

As seen in Table 4, the combined treatments continue to be superior 14 days after treatment. The treatment of Sivanto + imidacloprid + potassium silicate had the lowest mean value of 4.644 individuals, the Sivanto + potassium silicate treatment had a mean value of 6.000 individuals and the Sivanto + imidacloprid treatment had a mean value of 6.756 individuals. The untreated control continued to increase in numbers to the mean of 96.367 individuals. Boro cultivar was the worst infested and Abaa 99 the lowest overall mean. For the interaction between treatments and cultivars (LSD 0.05 = 0.0537), the lowest number was recorded for Sivanto + imidacloprid + potassium silicate on Abaa 99 (3.467 individuals), while the highest was

recorded for the untreated control on Boro (103.600 individuals).

Table 4. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, 14 days after treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	5.900	7.300	8.700	7.300
Imidacloprid	10.400	12.600	15.300	12.767
Potassium silicate	25.500	29.900	34.600	30.000
Sivanto + potassium silicate	4.600	6.000	7.400	6.000
Imidacloprid + potassium silicate	7.800	9.700	11.900	9.800
Sivanto + imidacloprid	5.300	6.667	8.300	6.756
Sivanto + imidacloprid + potassium silicate	3.467	4.567	5.900	4.644
Untreated control	89.300	96.200	103.600	96.367
Cultivar Mean	**19.033**	**21.617**	**24.463**	**21.704**
LSD 0.05	**Treatments = 0.0310 Cultivars = 0.0190 Interaction = 0.0537**			

The findings of this table are in line with the results of other scientific studies that demonstrated that thrips control could only be achieved using a plant's defensive status together with materials with direct effects, as reported by. [1] who described thrips as a difficult to control pest due to their small size and cryptic behaviour. Also, the role of potassium silicate is explained by the results of. [6] and [7] who reported that silicon increases mechanical barriers and defensive pathways; this may be the explanation for the superiority of treatment with Sivanto + potassium silicate compared to Sivanto alone.

Infestation 21 Days After Treatment

The number of thrips started to increase relatively speaking 21 days after treatment as compared with 7 and 14 days after treatment, as shown in Table 5; the differences were still very distinct compared with the untreated control. The treatment of Sivanto + imidacloprid + potassium silicate gave the lowest mean of 7.533 individuals, followed by the treatment of Sivanto + potassium silicate with a mean of 9.489 individuals and the treatment of Sivanto + imidacloprid with a mean of 11.478 individuals. The untreated control could reach 107.656 individuals. This means that the effect of the treatments is ongoing and the relative effectiveness of the treatments is on a downward trend. Regarding the cultivars, Abaa 99 had the lowest mean (24.208 individuals), followed by Buhuth 22 (27.604 individuals), whereas Boro had the highest mean (31.517 individuals), with significant differences among the three cultivars (LSD 0.05 = 0.2961). For the interaction between treatments

and cultivars (LSD 0.05 = 0.8374), the lowest number was recorded for Sivanto + imidacloprid + potassium silicate on Abaa 99 (5.867 individuals), while the highest was recorded for the untreated control on Boro (116.100 individuals).

Table 5. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, 21 days after treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	9.600	11.667	13.900	11.722
Imidacloprid	19.267	22.733	26.433	22.811
Potassium silicate	28.167	33.400	39.300	33.622
Sivanto + potassium silicate	7.533	9.267	11.667	9.489
Imidacloprid + potassium silicate	14.667	17.700	21.333	17.900
Sivanto + imidacloprid	9.300	11.100	14.033	11.478
Sivanto + imidacloprid + potassium silicate	5.867	7.367	9.367	7.533
Untreated control	99.267	107.600	116.100	107.656
Cultivar Mean	**24.208**	**27.604**	**31.517**	**27.776**
LSD 0.05	**Treatments = 0.4835 Cultivars = 0.2961 Interaction = 0.8374**			

The increase in relative numbers after 21 days can be explained by a partial breakdown of the active ingredient or regrowth of tissue not sprayed or re-infestation from a nearby source. This is in agreement with the results of thrips studies that show their population is linked to the plant growth stage and weather conditions [3]. The efficacy of the Sivanto-containing products is also continuing to show the systemic activity of flupyradifurone [4].

Infestation 30 Days After Treatment

All control treatments were lower than the untreated control, as shown in Table 6, which is the numerical increase 30 days following treatment. Treatment with Sivanto + imidacloprid + potassium silicate gave the lowest mean (12.656 individuals) followed by the Sivanto + potassium silicate treatment with a mean of 14.833 individuals, then the Sivanto + imidacloprid treatment (17.944 individuals), and the untreated control (123.067 individuals). At the cultivar level, Abaa 99 was the least infested and Boro had the highest overall mean. For the interaction between treatments and cultivars (LSD 0.05 = 0.4526), the lowest number was recorded for Sivanto + imidacloprid + potassium silicate on Abaa 99 (10.333 individuals), while the highest was recorded for the untreated control on Boro (131.700 individuals).

Table 6. Mean numbers of wheat thrips, *Haplothrips leucanthemi*, 30 days after treatment

Treatment	Abaa 99	Buhuth 22	Boro	Treatment Mean
Sivanto	16.500	19.200	22.400	19.367
Imidacloprid	30.300	34.500	39.900	34.900
Potassium silicate	31.200	36.800	42.700	36.900
Sivanto + potassium silicate	12.300	14.800	17.400	14.833
Imidacloprid + potassium silicate	22.500	26.400	30.600	26.500
Sivanto + imidacloprid	15.067	17.633	21.133	17.944
Sivanto + imidacloprid + potassium silicate	10.333	12.567	15.067	12.656
Untreated control	114.600	122.900	131.700	123.067
Cultivar Mean	**31.600**	**35.600**	**40.113**	**35.771**
LSD 0.05	**Treatments = 0.2613 Cultivars = 0.1600 Interaction = 0.4526**			

Protection from a single spray was not complete, but did help maintain a low thrips population compared to the untreated control as seen in the 30-day reading. This outcome is in line with the idea of integrated management, as using the insecticide alone may not be enough if there is still infestation happening. The findings also support earlier research by scientists, which suggested that the use of cultivars that are least susceptible to infestation within a wheat pest management program is important [9, 10].

Discussion

When looking at the overall results, the numbers of wheat thrips were most effectively reduced in the combined treatments, with Sivanto + imidacloprid + potassium silicate treatment followed predominantly by Sivanto + potassium silicate treatment. This is believed to be because flupyradifurone is a systemic insecticide with a mode of action on NAR [4] and the Sivanto-containing products are superior [3]. This also helped to enhance performance compared to the insecticide alone, as the role of silicon on strengthening plant tissues and activating plant defence mechanisms [6, 7, 8] may be responsible for this improvement.

Results also showed that cultivars differed significantly physiologically with Abaa 99 being the least infested cultivar on all dates and Boro being the highest infested cultivar. This could be due to variations in morphological, physiological, and chemical aspects of plants, which affect their ability to be established or fed upon by thrips. The result was similar to the previous scientific studies, which suggested that the resistance/susceptibility of wheat cultivars could be a significant factor in integrated pest management [9, 10, 19].

However, combinations of two insecticides with nervous system activity should be used carefully because there could be an increased selection pressure on the pest population. Combined treatments should be used as part of an insecticide rotation and integrated management program and should be based on the timing of insecticide applications, density of insect infestation, and consideration of natural enemies [15, 20].

Conclusions

The control treatments containing Sivanto showed clear efficacy in reducing wheat thrips numbers compared with the untreated control, and the Sivanto + imidacloprid + potassium silicate treatment recorded the lowest thrips numbers at all post-treatment assessment dates, followed mostly by the Sivanto + potassium silicate treatment. Potassium silicate alone showed a lower effect than the insecticides, but improved treatment performance when mixed with them, supporting its role as a natural resistance enhancer. Abaa 99 was the least infested cultivar, while Boro was the most heavily infested, indicating a physiological difference among cultivars in their susceptibility to wheat thrips infestation.

Recommendations

The study recommends incorporating the Sivanto + potassium silicate treatment into integrated management programs for wheat thrips, adopting field monitoring before and after spraying, selecting the cultivars least susceptible to infestation, and avoiding repeated reliance on mixing insecticides with similar modes of action except when necessary and within a well-studied rotation program.

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