ISSN: 2597-8713 (Online)
ISSN: 2598-5167 (Print)
AGRICULTURAL SCIENCE
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

A Comparative Study of Foliar and Soil Application of Potassium Fertilizer on Growth and Yield of Strawberry Cultivated in Non-Heated Greenhouses

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ABSTRACT

This study has been conducted in the non-heated greenhouse of the of Protected agriculture department of the Bakrajo Technical Institute of -Sulaymaniyah Governorate during winter season of 2019 The purpose of this study to determine the effect of soil fertilization and foliar application of potassium with different rates (0 as control , 1.5 , 2.5 and 3.gm/L) on strawberry cv. Rubygem growth and yield. The parameters recorded were number of leaf per plant, number of flower per plant, number of fruit per plant, weight of fruit (gm), total acidity % of fruit (T.A) and total soluble solid (TSS) of the fruit. According to the results of most of the parameters of this study the foliar application of the fertilizer (K) is better than applying the fertilizer of soil in most parameters. The highest value of number of leaf, flower, fruit and fruit weight gained from potassium in rate 1.5gm/L in both methods. While the highest value of total soluble solid (T.S.S) obtained from 3.5gm/L which was %12.87, and the highest value of T.A was significantly gained from the control which was % 0.51. As regards to interaction between soil and foliar fertilizer, the highest number of leaf was gained from control at foliar application without any significant value with the other rates, and the highest significant value in number of flower was gained from 1.5gm at foliar application. While the highest value of fruit weight was gained from foliar application with 3.5gm and soli fertilizer with 1.5gm of potassium without any significant value between the two treatments which are 21.72gm and 20.12gm successively, and the highest significant value of total acidity was gained from control at foliar application which is %0.54. As regards to total soluble solid the highest significant value was obtained from 3.5gm in soil fertilizer which is %14.25.

Keywords: Strawberry, Rubygem, Potassium, Plastic house, Foliar Application

1. INTRODUCTION

The Strawberry Fragaria ananassa (Duchesne) has unique desirable taste, pleasant aroma and is a major source of vitamins: potassium, fibre, phenolics, flavonoids and the immense source of sugars (Sharma & Sharma, 2004). (Strawberry) is a nutritious fruit plant of Rosaceae family (Sharma & Shyan, 2009). Rubygem, a new short-day strawberry (Fragaria ananassa Duch.), produces high yields of moderately firm, attractive well-flavoured fruit from

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late autumn through early spring in the strawberry-growing district in Southeast Queensland. Rubygem is recommended for trial in areas with mild winter climate, especially where rainfall is unlikely and a well-flavoured berry is required (Mark E. Herrington1 etal. 2007.)

Strawberry belongs to the rosaceae family and this fruit has different names such as berries, ground berries and strawberries. It is a neglected plant that grows naturally in the forest and this plant was known only as a wild plant. Strawberry cultivation lasts 2-3 years, so it responds to fertilization well, especially after planting strawberry and during the period of growth and fruiting it needs sufficient quantities of fertilizer elements which contains the elements of potassium and phosphorus and it is preferable not to use nitrogen fertilizer because it leads to the strong vegetative growth at the expense of fruiting (Taha Shex, 2007).

Potassium is one of the major elements the plant needs in relatively large quantities and it plays an important role in the formation of carbohydrates, sugars and division of the cell and regulate the degree of interaction within the cell and improves the quality of fruits (Amran, 2005). Foliar fertilization is more successful in light soils compared to heavy species and rich in organic materials (Jargons, 2007). Adding potassium through soil or spraying it on the leaves is essential for the growth and production of strawberry (Borc, 2001). Potassium fertilization is of particular importance in improving the quality of fruits in terms of hardness, taste and solids content, while noting decreases in acidity of the fruit by increasing potassium fertilization (Hassan et al., 2003). The potassium is necessary for good colouring and sugar content in fruits and it increases its resistance to cold winter (Strawberry fertilizer 2007). In addition, potassium has an important role in photosynthesis process and produces carbohydrate, sugar and protein. Accordingly, it causes increase in the number of flower (alshabiny, 2007).

2. RESEARCH METHOD

The experiment was carried out in the greenhouse of the Department of Protected agriculture at Bakrajo technical Institute, Sulaymaniyah Governorate , during the winter season in 2019 to conduct a comparative study between foliar and soil application of potassium on some Vegetative Growth Traits and Yield of strawberry faragaria ananassa cv. Rubygem cultivated in Non-Heated Greenhouses. The dimensions of the plastic house were (50 m length, 9 m width and 3.5 m height). The drip irrigation system was laid along the length of the terrace. The data were collected randomly from 3 plants in each replicate as follows:

N. of leaf = no.of leaf from 3 plant

N.of flower/plant = no.of flower from 3 plants

N.of fruit/plant = no. of fruit

Weight of fruit = total weight of fruit

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Number of fruit

Total soluble solid (TSS) was recorded by hand refractometer directly after fruit harvesting (ranganna,1977)

Titrable Acidity (TA) was taken BY Titration with NA0H by 2-3 drops of phynonafthalin in this way :

$$\%T.A = \frac{T.N.EQ}{Vs*1000} * 100$$

T= volume of NAOH

N= normality of NAOH (0.1N)

Eq = equivalent of stric acid (64) .

VS = volume of strawberry juice (5ml) .

Statistical Analysis

In this study the four levels of potassium (0.0, , 1.5 ,2.5 and 3.5 g / litter) in four replications were applied by two types of fertilizer (foliar application and soil fertilizer. Thus, the experimental unit became 32 treatments (2*4*4 =32) Potassium fertilizer was installed in two doses; first after 4 weeks of planting and second at the begging of flower set. The experimental design used in this study was complete randomize block design R.C.B.D , was applied, comparisons between characters mean was carried out according to Duncan‟s tests at a significant level of 0.05 (25).

3. RESULTS AND DISCUSSION

Table1. The main effect of fertilizer type (foliar and soil application) on (number of leaf/plant. Number of flower/plant, number of fruit/plant, Weight of fruit/plant, total soluble solid (%TSS) and total acidity (T.A) .

Potassium Fertilizer	No.of leaf/p	No.of flower/p	No.of fruit/p	Weight of fruit /p (gm)	%TSS	T.A%
Foliar	11.13a	16.31a	14.82a	18.93 a	11.50 b	0.44a
S0il	10.50a	13.46b	12.95a	16.04 a	13.00 a	0.40 b

*Means in the same column followed by the same symbol are not significantly different at $p \leq 0.05$ level based on Duncan test.

According to the results of table (1), it is clarified that the foliar application of (K) is better than soil fertilizer in all parameters except total soluble solid (TSS) . As regards to number of leaf/plant, number of fruit/p and weight of fruit/p, the highest values were gained from foliar application without any significant difference with the soil fertilizer. While the

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significant value of number of flower/p and total acidity gained from foliar application which is 16.31 and %44 successively, finally the highest significant value of total soluble solid obtained from soil fertilizer is %13.00.

Table 2. The effect of potassium rate on (number of leafe/plant. Number of flower/plant,number of fruit/plant,Weight of fruit/plant, total soluble solid (TSS) and total acidity (T.A) .

Rate of potassiam	n.of leaf/p	n.of flower/p	No.of fruit/p	Weight of fruit (gm)	%TSS	%TA
Control	11.08a	14.22a	13.36a	14.97 b	12.25a	0.51a
1.5	10.62a	15.98a	15.38a	19.68a	11.37a	0.43b
2.5	10.88a	14.81a	13.11a	16.95ab	12.50a	0.32c
3.5	10.69a	14.51a	13.69a	18.42ab	12.87a	0.42b

*Means in the same column followed by the same symbol are not significantly different at p ≤ 0.05 level based on Duncan test .

The table clearly demonstrates that the potassium rates did not show different significant effects on those parameters except fruit weight and total acidity which are the highest significant values of fruit weight /p gained from 2.5g potassium and the highest significant value of T.A observed in control is %0.51 and the lowest value is gained from 2,5g which is % 0.32.

Table 3. the effect of interaction between foliar an soil fertilizer on (number of leafe/plant , number of flower/plant,number of fruit/plant,Weight of fruit/plant, total soluble solid (TSS) and total acidity (T.A) .

(K) fertilizer	K(gm/L)	No.of leave/p	No.of flower/p	No.of fruit/p	Weight of fruit (gm)	%TSS	%T.A
Foliar application	Control	12.13a	10.05ab	14.91ab	18.58a	11.00c	0.54a
	1.5	11.71a	18.83a	18.00a	19.09a	11.00c	0.45bc
	2.5	9.65a	14.67ab	11.60b	16.34ab	12.50abc	0.32e
	3.5	11.06a	15.68ab	14.78ab	21.72a	11.50bc	0.44bcd
Soil fertilizer	Control	10.02a	12.39b	11.81b	11.37b	13.50ab	0.48b
	1.5	9.52a	13.14ab	12.77ab	20.12a	11.75bc	0.41cd
	2.5	12.10a	14.96ab	14.61ab	17.56ab	12.50abc	0.33e
	3.5	10.33a	13.33ab	12.59b	15.13ab	14.25a	0.40d

*Means in the same column followed by the same symbol are not significantly different at p ≤ 0.05 level based on Duncan test.

Concerning the interaction between foliar and soil fertilizer with potassium rates, a different significant value has been observed. The result showed that the highest value of number of leaf/plant was gained from foliar with control without any significant difference with the other rates, the highest significant value of flower number and number of fruit were gained from 1.5g potassium with foliar application which is 18.83, 18.00, and the lowest value of number of flower was observed from control in both treatments which is 10.05 and 12.39, (Bibi1, et al. 2016). Regarding to the fruit weight the highest value was obtained from foliar application with 3.5g of (K) rate which was 21.72g, but non-significant differences were observed between them. Some results showed that increasing of the potassium concentration to 300 ppm in nutrient solution increased fruit weight (Ebrahimi et al. (2012). According to the interaction effects between foliar and soil fertilizer on total soluble solid the significant value was gained from soil fertilizer with 3.5g of potassium which is %14.25 (khayt ,etal 2009). Finally the highest significant value of total acidity was obtained from control in foliar fertilizer, from which we can conclude that the acidity became less with the increase in the potassium rate (hassan, etal.2003) (Muhamat, Polat 2016) in their study of effect of different doses of potassium on T.A, they noticed that increasing of potassium dose was due to the decrease of total acidity.

4. CONCLUSIONS

From the experimental results of this study it that the foliar application of potassium gave is better results than soil application fertilizer of potassium because foliar application has shown a significant effect on different vegetative and productive characters of strawberry plant, as seen in the number of fruits per plant, number of flower, weight of fruit and total acidity.

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