IMPACT OF SPRAYING WITH POTASSIUM, ZINC AND *ARTEMISIA INCULTA* EXTRACT ON FLOWERING, SETTING AND ANATOMICAL FEATURE OF *Vicia Faba,* L. PLANTS

ALI, T.B. [1], G.S.A. EISA[2] AND A. A. KHALAFALLAH[3]

1. Veg. Res. Dept., Hort. Res. Inst., Agric. Res. Center
2. Agric. Botany and Plant Path. Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.
3. Botany Depart. Womens College for Arts, Science and Education, Ain Shams Univ.

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Abstract

This investigation was carried out during the two successive seasons of 2006 - 2007 and 2007 – 2008 on *Vicia faba,* L. cv. Kassasin 1. The aim was to study the effect of spraying with potassium at rates 0.3 and 0.6 % K_2O, zinc at rates 100 and 200 ppm and *Artemisia inculta* extract at rates 5 and 10 cm^3/l as well as different combination treatments among them at vegetative growth and flowers initiation on growth, flowering, yield and its components and some anatomical feature. Plants were sprayed three times at 30, 45 and 60 days after sowing.

All spraying materials showed a significant increase in plant growth, flowering, setting, quantity and quality of yield and anatomical structure as compared to untreated check.

Spraying plants with *Artemisia inculta* extract at rate 5 or 10 cm^3 /l led to improve plant height, number of leaves and branches/plant and dry matter/plant, flowering, setting and yield and its components (pod length, pod weight, number of pods/plant and pod yield/fed) more than spraying with potassium and zinc. Meanwhile, potassium effect had uppermost improving zinc effect on characters under study. As for the effect of spraying materials on anatomical structure of stem and leaf, results indicated positive effects with all the studied characters of plant organs.

In general, spraying *Vicia faba*, L. plants with combination of potassium, zinc and *Artemisia inculta* extract at all different concentrations showed significantly increase on plant growth, flowering, setting, yield quantity and quality and anatomical structure than spray with them alone or control.

INTRODUCTION

Vicia faba, L. is one of the principal winter *Fabaceae* crops in Egypt as a source of protein in food. It can be able to utilize atmospheric nitrogen in a process called nitrogen fixation via rhizobium bacteria. It is mainly cultivated for local consumption, since, pods harvested either at green pod stage for fresh market or at mature stage for dry seeds. *Vicia faba,* L. plants produce numerous flowers, but the most of them are dropping. There are many factors affect on flowering and flowers setting

percentage. Great attention has been focused on the possibility of using natural and safety substances, .i.e. potassium, zinc and *Artemisia inculta* extract in order to improve growth and yield.

Potassium is one of the essential nutrients needed by the plants and plays a highly recognized role in plant life. Moreover such nutrient improves the quantity and quality of pods (Abd Allatif *et al.*, 2002).

Micro-nutrients play an important role in plant metabolism. The role of zinc as a micro-element has been reported by many researchers. Zinc is known to be required for a variety of metabolic processes in plants such as photosynthetic reactions, nucleic acids metabolism, proteins and carbohydrates biosynthesis and starch metabolism (Srivastava *et al.*, 1997). Zinc is necessary for the synthesis of tryptophan and hence indirectly for the synthesis of auxin. The activities of a number of respiratory enzymes, the accumulation of quinines and catechol aggregates, respiratory impairment, changes in the levels of proteins and amino acids have been reported to follow restrictions in the zinc supply (Klein *et al.*, 1962). It is well known, that zinc positively affects cell division and expansion. Moreover, zinc was found to ameliorate plant growth under saline soils (Shukla and Mukhi, 1985).

The positive effects of zinc on the growth and yield have been observed by many investigators such as Agwah and Mahmoud (1994) and Agwah and Mahmoud (1994), on tomato and Fayza *et al.* (2007) on pepper plants, found that spraying plants with Zn solution significantly increased fruit setting and early and total yield.

Water extracts of the flowering tops and leaves of *Artemisia* plants have many antioxidants, some organic acid such as artemisinic acid and essential oils such as artemisinin oil (Shi *et al.*,1999 and Gascon *et al.*,1999). Sukul *et al.* (1999) found that sprayed *Vigna unguiculata* with extracts of the flowering tops and leaves of *Artemisia maritima* improved growth in terms of shoot length, shoot weight, root length and number of bacterial nodules.

Spraying plants with antioxidants have a positive effect on plant growth, yield quantity and quality, stimulate nutrient absorption and to overcome the harmful effect of some environmental stresses on plant growth (Abd El-Naem, 2005).

The present study was undertaken to evaluate the effect of spraying with some materials (potassium, zinc and *Artemisia inculta* extract) which will be considered an attempt to improve flowering and flowers setting percentage, which reflect on yield quantity and quality of *Vicia faba*, L. cv. Kassasin 1..

MATERIALS AND METHODS

Two field experiments were carried out during the two successive seasons of 2006 - 2007 and 2007 - 2008 at the Experimental Farm of El-Kassasin Horticultural Research Station, Ismailia Governorate, to study the effect of spraying with potassium, zinc, *Artemisia inculta* extract and different combination among them on growth, flowering, setting and anatomical feature of *Vicia faba*, L. cv. Kassasin 1. The soil of the Experimental field was sandy in texture, the physical and chemical analyses of soil are shown in Table (1).

Table 1. Physical and chemical analysis of the experimental soil.

Sand %	88..24	HCO_3^-	1.00
Silt %	4.25	Cl^-	0.50
Clay %	7.51	SO_4^{--}	0.97
Soil texture	sandy	Macro-elements (ppm)	
F.C. %	11.21	N	81
W.P. %	2.24	P	23
Organic matter %	0.44	K	103
pH	8.1	Micro-elements (ppm)	
E.C. (mmohs/cm)	1.21	Fe^{++}	2.0
$CaCO_3$	2.6	Cu^{++}	0.16
Soluble ions (meq/L)		Zn^{++}	0.26
Ca^{++}	1.00	Mn^{++}	0.80
Mg^{++}	0.40		
Na^+	0.76		
K^+	0.31		

Seeds were sown in hills (2 seeds/hill) in two sides of line as 20 cm apart on 19th and 24th October in 2005 and 2006 seasons, respectively. The experiment included 15 treatments as follows:

1. Control (sprayed water).
2. Sprayed with zinc at rate 100 ppm.
3. Sprayed with zinc at rate 200 ppm.
4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter.
5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter.
6. Sprayed with K_2O at rate 0.3 %.
7. Sprayed with K_2O at rate 0.6 %.
8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter.
9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter.
10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter.
11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter.
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter.
13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter.
14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter.
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter.

Vine *Artemisia inculta* were finely ground and soaked for 24 hours in water at rate 1 km/10 liter water then filtrate extract for using.

These treatments arranged in a complete randomized block design with three replications. The experimental unit area was 21 m^2 (4.2 x 5 m) and each unit contained six rows with 5 m length for each and 70 cm width of them, four inner rows were possessed for yield determination, whereas the two outer rows were for determination of plant growth characters. One row was left between two experimental plots to avoid the overlapping. Plants were sprayed three times at age 30, 45 and 60 days after sowing, the normal agricultural practices of *Vicia faba*, L. production under drip irrigation system of this area were followed according to the recommendations of Agriculture Ministry.

Data recorded

A. Plant Growth

A random sample of six plants from each plot was taken at flowering stage (60 days) and the following data were recorded plant height (cm), number of leaves/plant, number of branches/plant,

Dry weight of whole plant (gm):

A random sample of other six plants from each plot was taken and dried at 70^0C till constant weight and the dry weight of whole plant was determined

B. Green Pods Yield and Quality

Mature green pods were continuously harvested when reached suitable maturity stages. The following data were recorded:

1. Average pod length (cm).
2. Average pod weight (gm).
3. Number of green pods/plant = $\frac{\text{Total number of green pods /plot}}{\text{Number of plants/plot}}$
4. Green pods yield

Total green pods yield (tons/fed) was calculated on the base of total yield along harvesting stages by summing (the sum of all harvests).

C. Flowering and setting characters

A random sample of five plants from each plot were labeled and the following data were recorded

1. Number of flowers/plant.
2. Setting percentage = $\frac{\text{Total number of green pods/plant} \times 100}{\text{Total number of flowers/plant}}$
3. Height of 1^{st} pod on the main stem (cm).
4. Net weight of seeds percentage = $\frac{\text{Total weight of green seeds} \times 100}{\text{Total weight of green pods}}$
5. Number of seeds/pod.

Anatomical study

Specimens of selected treatments at the age of 120 days from the middle part of the 6th internode and its leaf from apex of the *Vicia faba,* L. plants were made in sections as described by Willy (1971). The sections were photographed by using light microscope (Olympus) with digital camera (Canon Power Shot S80) connected to computer, the photographs were taken by Zoom Browser Ex program. The dimensions of stems and leaves sections were measured by using Corel Draw program ver. 11.

Statistical analysis

The obtained data subjected to statistical analysis according to statistical analysis of variance according to Snedecor and Cochran (1980) and the means separation were done according to Duncan (1958).

RESULTS AND DISCUSSION

1- Vegetative Growth

Results given in Table 2 show the effect of spraying with zinc, potassium, *Artemisia inculta* extract and different combination treatments among them as well as water spray (control) on plant height, number of leaves and branches/plant and dry matter of whole plant. It is obvious that vegetative growth (except number of branches/plant) was promoted with all spraying materials as compared to control (sprayed water). This may be due to potassium plays a highly recognized role in plant life (Abd Allatif *et al.*, 2002) and zinc is known to be required for a variety of metabolic processes in plants such as photosynthetic reactions, nucleic acids metabolism, proteins and carbohydrates biosynthesis, starch metabolism, and necessary for the synthesis of tryptophan and hence indirectly for the synthesis of auxin (Klein *et al.*, 1962).

Spraying plants with *Artemisia inculta* extract alone at all concentrations recorded the uppermost values of plant height, number of leaves/plant and dry matter of whole plant than spraying with zinc or potassium alone effect. Meanwhile, sprayed plants with potassium alone increased vegetative growth more than zinc alone. This may be due to that *Artemisia* plants extract have many antioxidants, some organic acid such as artemisinic acid and essential oils such as artemisinin oil (Shi *et al.,* 1999 and Gascon *et al.,* 1999). Sukul *et al.* (1999) found that sprayed *Vigna unguiculata* with extracts of the flowering tops and leaves of *Artemisia maritima* improved growth in terms of shoot length, shoot weight, root length and number of bacterial nodules. Also, antioxidants have positive effect on plant growth, stimulate nutrient absorption and to overcome the harmful effect of some environmental stresses on plant growth (Abd El-Naem, 2005).

In general, spraying *Vicia faba,* L. plants with combination of potassium, zinc and *Artemisia inculta* extract at all different concentration showed significantly

increase on plant height, number of leaves/plant and dry matter/plant than spray with them alone or control.

2- Pods physical characters and yield

The effect of spraying with potassium, zinc, *Artemisia inculta* extract and different combination among them on pods physical characters and yield (pod length, pod weight, number of pods/plant and pods yield/fed) are shown in Table 3.

It is evident from the data that, sprayed plants with zinc did not reflect any significant effect on pod length, pod weight, number of pods/plant and pods yield/fed, this may be due to that plants received enough amounts of micro-elements from organic manure applied to soil. On the other hands, sprayed plants with *Artemisia* extract or potassium alone had a positive effect on pods physical characters and yield as compared to control. These results agree with those obtained by Abd Allatif *et al.* (2002) found that sprayed plants with potassium improves the quantity and quality of pods.

Sprayed with *Artemisia* extract alone caused a significant increase in pods physical characters and yield more than potassium effect. This may be due to *Artemisia* plants extract have many antioxidants which had a positive effect on yield quantity and quality, stimulate nutrient absorption and to overcome the harmful effect of some environmental stresses on plant growth (Abd El-Naem, 2005).

In general, the best treatment for increasing pods physical characters and yield was that of plants sprayed with combination of potassium, zinc and *Artemisia inculta* extract at different concentrations than those sprayed with individual treatments or control. This may be due to positive effect of potassium, zinc and *Artemisia* extract on physiological processes in plant which reflect on yield quality and quantity, and sprayed plants with mixed of them gave the maximum beneficial than each of them alone.

3- Flowering, setting and yield quality characters

Table 4 shows the effect of potassium, zinc, *Artemisia inculta* extract and different combination among them on number of flowers/plant, setting percentage, number of seeds/pod, net weight of seeds percentage and height of 1st pod on main stem. It is clear from such data that all spraying materials showed a significant increase in number of flowers/plant, setting percentage, number of seeds/pod and net weight of seeds percentage. But they showed a significant decrease in height of 1st pod on main stem as compared to control (sprayed water).

Results indicate that spraying plants three times with 200 ppm zinc alone at age 30, 45 and 60 days after sowing significantly increased number of seeds/pod in first season only, but decreased height of 1st pod on main stem more than control in both seasons of study. The presented results coincide with those reported by Agwah and Mahmoud (1994), on tomato and Fayza *et al.* (2007) on pepper plants, found that

spraying plants with Zn solution significantly increased fruit setting and early and total yield.

Results indicate also that spraying plants three times with 5 or 10 cm^3/liter *Artemisia* extract alone caused a significant increase in setting percentage in both seasons and net weight of seeds percentage in second season only, meanwhile spraying plants with *Artemisia* extract significantly decreased height of 1st pod on main stem more than potassium, zinc and control. These results agree with those obtained by Sukul *et al.* (1999).

Spraying *Vicia faba*, L. plants with 0.3 or 0.6 % K_2O alone at age 30, 45 and 60 days showed a significant increase in net weight of seeds percentage, and showed a significant decrease in height of 1st pod on main stem more than zinc, *Artemisia* extract and control. These results may be due to that potassium plays a highly recognized role in plant life. Moreover such nutrient improves the quantity and quality of pods (Abd Allatif *et al.*, 2002).

Table also showed that, the best treatment for increasing number of flowers/plant, setting percentage, number of seeds/pod, net weight of seeds percentage and height of 1st pod on main stem was sprayed plants with combination among of potassium, zinc and *Artemisia inculta* extract at different concentrations than spray with them alone. Thus, it could be concluded that spraying *Vicia faba*, L. plants grown under sandy soil conditions with the combination among potassium, zinc and *Artemisia inculta* extract at different concentration was the superior treatment for improving flowering, setting and yield quality characters.

Anatomical feature

a- Stem anatomy

Table (5) and Fig 1 represent the anatomical features of stem of *vicia faba*, L. plants foliar sprayed by different concentrations of potassium, zinc and *Artemisia inculta* extract. Spraying *vicia faba*, L. plants by single treatments of potassium (0.3 or 0.6 % K_2O), Zn (100 or 200 ppm) and *Artemisia inculta* extract (5 or 10 cm^3/L) significantly increased stem diameter, pith diameter cortex thickness, number of vascular bundle/section and average of vascular bundle thickness more than control treatments (sprayed water). While spraying plants with potassium at any concentrations (0.3 or 0.6 % K_2O) gave the highest values of stem diameter, pith diameter, number of vascular bundle/section and average of vascular bundle thickness comparatively to those sprayed with zinc and *Artemisia inculta* extract at different concentrations. Meanwhile, spraying plants with zinc at rate 100 ppm recorded the highest value of cortex thickness as compared to other spraying and control.

As for as, the effect of interaction between potassium, zinc and *Artemisia inculta* extract on some anatomical structure are shown in Table 5 and Fig. 1, it is obvious from the data that all interaction treatments were superior than the control treatment

in all anatomical structure study (stem diameter, pith diameter cortex thickness, number of vascular bundle/section and average of vascular bundle thickness) and also than the individual treatments in some anatomical structure (pith diameter, number of vascular bundle/section and average of vascular bundle thickness). In general, spraying *Vicia faba*, L. plants with single solution or combination of potassium, zinc and *Artemisia inculta* extract at all different concentration showed significantly increase all anatomical structure study.

b- Leaf anatomy

The data which recorded in Table (6) and Fig.2 represent the anatomical measurements of leaf dimensions (midvien thickness, midvein width, midvein vascular bundle thickness, midvein vascular bundle width, blade thickness, spongy tissue thickness and number of xylem arms) of *Vicia faba*, L. plants foliar sprayed with different concentrations of potassium, zinc and *Artemisia inculta* extract. Generally, the most of spray treatments (single solution or all combinations) increased midvein thickness, midvein width, midvein vascular bundle thickness, midvein vascular bundle width, blade thickness, spongy tissue thickness and number of xylem arms as compared to control treatment (spray water).

Plants sprayed with 0.3 % K_2O +200 ppm zinc + 10 cm^3 *Artemisia inculta* extract/liter gave the highest values of midvien thickness, blade thickness and spongy tissue thickness than other treatments (single and combinations). On the other side, plants sprayed with 0.3 % K_2O + 200 ppm zinc + 5 cm^3 *Artemisia inculta* extract/liter recorded the highest values of midvein vascular bundle thickness and midvein vascular bundle width than other treatments. Plants sprayed with 0.6 % K_2O + 200 ppm zinc + 5 cm^3 *Artemisia inculta* extract/liter showed the highest value of midvein width than other treatments, but plants sprayed with 0.6 % K_2O + 200 ppm zinc + 10 cm^3 *Artemisia inculta* extract/liter gave the best value of number of xylem arms more than other treatments.

The present results indicated that *Artemisia inculta* extract combined with K and Zn has positive effects on stem and leaf anatomical features due to the antioxidant constituents and organic acids in *Artemisia inculta* extract, role of potassium in regulating plant water relations and role of Zn which acts as co-factors for many enzymes including in the different metabolic processes and synthesis of auxins, which stimulate cell division and expansion (Mohamed and Saif El-Yazal, 2004).

Mohamed (2005) found that spray *vicia faba*, L. plants with fertilizers containing potassium increased section diameter and number of xylem vessels and their diameter, but decreased pith dimensions.

Conclusion

It could be concluded that spraying *Vicia faba*, L. plants grown under sandy soil conditions with the combinations among potassium, zinc and *Artemisia inculta*

extract at different concentrations under study was the superior treatment for improving flowering, setting and yield quality characters.

Table 2. Effect of spraying with potassium, zinc and *Artemisia inculta* extract on vegetative growth of *Vicia faba,* L. plants throughout seasons 2006 - 2007 and 2007 - 2008.

Characters / Treatments	Plant height (cm)		No of leaves/plant		No of branches/plant		Dry matter/plant (g)	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season
1	80.68^{e}	75.44^{a}	40.54^{a}	40.05^{a}	2.60^{a}	2.87^{a}	84.51^{a}	77.60^{a}
2	87.65^{a}	83.05^{ab}	44.17^{ab}	43.25^{ab}	2.88^{a}	2.79^{a}	95.42^{ab}	92.86^{ab}
3	91.45^{a}	95.37^{bc}	45.29^{ab}	41.72^{ab}	2.71^{a}	2.53^{a}	105.94^{bc}	99.59^{bc}
4	106.83^{cd}	112.65^{cd}	48.47^{b}	52.67^{bc}	3.07^{a}	2.57^{a}	116.41^{cd}	109.27^{bcd}
5	110.73^{cd}	114.70^{d}	54.83^{c}	53.41^{bc}	3.00^{a}	2.80^{a}	119.57^{cd}	121.72^{d}
6	93.89^{abc}	99.60^{c}	47.52^{ab}	44.37^{ab}	3.06^{a}	3.29^{a}	108.36^{bc}	111.36^{bcd}
7	98.72^{bc}	96.71^{bc}	44.59^{a}	45.26^{a}	2.82^{a}	3.47^{a}	108.91^{bc}	102.97^{bc}
8	117.13^{de}	121.90^{e}	55.87^{c}	53.76^{bc}	2.87^{a}	3.04^{a}	122.55^{d}	119.85^{cd}
9	125.77e	124.80^{e}	60.92^{cd}	63.60^{cd}	2.62^{a}	2.76^{a}	124.15^{d}	121.93^{d}
10	123.60^{e}	124.26^{e}	64.78^{d}	60.34^{cd}	3.01^{a}	2.46^{a}	122.18^{d}	124.61^{d}
11	128.47^{e}	124.13^{e}	69.68^{e}	59.61^{cd}	3.25^{a}	2.86^{a}	124.15^{d}	125.06^{d}
12	124.93^{e}	122.97^{e}	62.37^{d}	61.64^{d}	3.27^{a}	3.17^{a}	123.23^{d}	122.71^{d}
13	126.43^{e}	126.10^{e}	72.46^{e}	68.65^{d}	3.08^{a}	3.37^{a}	128.92^{d}	126.78^{d}
14	123.50^{e}	123.37^{e}	65.93^{de}	68.64^{d}	3.16^{a}	2.92^{a}	122.74^{d}	124.10^{d}
15	124.50^{e}	123.87^{e}	72.02^{e}	69.42^{d}	2.89^{a}	3.26^{a}	127.72^{d}	129.71^{d}

1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm 3. Sprayed with zinc at rate 200 ppm

4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 6. Sprayed with K_2O at rate 0.3 % 7. Sprayed with K_2O at rate 0.6 %

8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Table 3 Effect of spraying with potassium, zinc and *Artemisia inculta* extract on pods physical characters and yield of *Vicia faba*, L. plants throughout seasons 2006 - 2007 and 2007 - 2008.

Characters / Treatments	Pod length (cm)		Pod weight (g)		No of pods/plant		Pods yield/fed (ton)	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season
1	8.05^{a}	7.49^{a}	69.14^{a}	59.40^{a}	6.48^{a}	5.70^{a}	3.103^{a}	2.955^{a}
2	7.67^{a}	7.69^{a}	87.83^{ab}	85.01^{ab}	8.35^{ab}	8.57^{a}	3.340^{ab}	3.360^{ab}
3	8.66^{ab}	8.54^{a}	94.80^{ab}	94.37^{abc}	9.17^{abc}	9.24^{ab}	3.492^{ab}	3.608^{bc}
4	11.60^{c}	10.87^{b}	114.91^{bc}	125.54^{bcd}	11.66^{cd}	13.31^{cd}	3.910^{cd}	3.867^{bc}
5	11.97^{c}	12.27^{bc}	131.97^{cd}	132.20^{cd}	12.73^{d}	12.90^{bcd}	4.178^{cde}	4.043^{cd}
6	9.78^{bc}	10.80^{b}	100.63^{ab}	124.10^{bcd}	9.50^{abc}	10.00^{abc}	3.705^{bc}	3.625^{bc}
7	10.52^{c}	10.90^{b}	110.78^{bc}	106.95^{bc}	11.09^{bcd}	10.67^{abc}	3.806^{bc}	3.819^{bc}
8	11.63^{c}	12.07^{bc}	146.65^{de}	139.08^{de}	14.17^{de}	14.13^{de}	4.289^{def}	4.319^{de}
9	12.03^{c}	12.37^{bc}	149.92^{de}	158.49^{def}	14.60^{de}	15.96^{de}	4.444^{ef}	4.311^{de}
10	12.03^{c}	11.27^{bc}	149.14^{de}	153.29^{def}	14.53^{de}	14.78^{de}	4.374^{ef}	4.348^{de}
11	11.90^{c}	11.87^{bc}	175.28^{f}	171.92^{ef}	16.65^{e}	16.77^{de}	4.642^{fg}	4.504^{d}
12	11.90^{c}	12.77^{c}	167.30^{ef}	173.50^{ef}	15.75^{e}	16.95^{e}	4.630^{fg}	4.671^{d}
13	12.30^{c}	12.17^{bc}	192.08^{f}	192.44^{f}	18.53^{e}	17.90^{e}	4.834^{g}	4.698^{e}
14	12.13^{c}	12.63^{c}	176.25^{ef}	173.85^{e}	16.67^{e}	14.57^{de}	4.739^{g}	4.751^{e}
15	11.63^{c}	12.20^{bc}	193.82^{f}	168.58^{ef}	17.98^{e}	18.21^{e}	4.873^{g}	4.754^{e}

1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm 3. Sprayed with zinc at rate 200 ppm
4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 6. Sprayed with K_2O at rate 0.3 % 7. Sprayed with K_2O at rate 0.6 %
8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Table 4. Effect of spraying with potassium, zinc and *Artemisia inculta* extract on some flowering, setting and yield quality characters of *Vicia faba,* L. plants throughout seasons 2006 - 2007 and 2007 - 2008.

Characters	No of flowers/plant		Setting percentage		No of seeds/pod		Net weight of seeds %		Height of 1st pod on main stem(cm)	
Treatments	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season
1	17.76a	17.07a	36.30a	35.32a	4.03a	4.30a	49.80a	49.98a	36.17e	37.62d
2	19.15ab	18.51ab	43.65ab	46.38ab	4.56ab	4.42a	52.69ab	53.17ab	27.58d	26.58c
3	18.18a	18.33a	50.58ab	50.40abc	5.30bc	5.02ab	53.17ab	54.23ab	25.53cd	24.38c
4	20.32ab	19.69abc	57.43bcde	67.75bc	5.23bc	5.10ab	59.53a	57.69abc	22.54bc	23.36bc
5	21.02abc	20.95abc	60.66bcde	61.85bc	5.43bc	4.86ab	61.47abc	60.49bcd	18.91ab	17.48a
6	19.91ab	19.00abc	46.99abc	53.24abc	4.80a	5.28abc	66.21bc	65.71cd	25.52cd	26.43c
7	21.26abc	18.74ab	52.24abcd	56.93abc	4.96a	5.32abc	66.34bc	70.57d	24.85c	24.95c
8	23.27bc	23.13bcd	61.09bcde	61.31abc	5.99c	5.70bc	64.90abc	68.61cd	18.14ab	19.14ab
9	24.54bc	23.93cd	59.99bcde	67.11bc	5.94c	5.96bc	69.38c	67.41cd	18.84ab	18.64ab
10	21.21abc	21.14abc	69.13de	70.85bc	5.89c	5.92bc	72.41c	67.70cd	16.91a	16.76ab
11	20.34ab	21.60abc	83.18e	77.95c	5.89c	6.36c	75.38c	73.05d	18.93ab	16.92a
12	20.77ab	25.61cd	77.15e	64.61bc	6.07c	6.06bc	70.74c	68.79cd	17.36ab	17.43a
13	26.02c	24.76cd	71.66e	73.33c	6.07c	6.33bc	71.96c	72.48d	15.49a	18.02ab
14	26.69c	26.40d	63.11cde	55.58abc	6.02c	5.74bc	72.37c	77.47e	17.15ab	16.61a
15	26.22c	25.90cd	68.83de	70.31c	5.78c	5.74bc	62.60abc	78.31e	17.41ab	17.09a

1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm 3. Sprayed with zinc at rate 200 ppm
4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 6. Sprayed with K_2O at rate 0.3 % 7. Sprayed with K_2O at rate 0.6 %
8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Table 5. Anatomical characteristics of *vicia faba*, L. stem sprayed with potassium, zinc and *Artemisia inculta* extract throughout seasons 2006 - 2007 and 2007 - 2008.

Characters Treatments	Stem diameter (µ)	Pith diameter (µ)	Cortex thickness (µ)	No of vascular bundle/ section	Vascular bundle thickness (µ)
1	5008	2291	252	20	233
2	5418	2814	355	24	285
3	6457	3446	282	24	280
4	6564	3575	268	24	329
5	5974	2962	289	28	332
6	6359	2866	274	28	377
7	6389	4137	316	28	300
8	5469	3331	314	28	378
9	5239	3455	302	28	318
10	6200	3280	280	24	324
11	6444	3883	313	28	437
12	5394	3506	332	48	322
13	6222	3856	262	32	395
14	6540	3986	333	28	437
15	6270	4312	311	52	352

1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm 3. Sprayed with zinc at rate 200 ppm 4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 6. Sprayed with K_2O at rate 0.3 % 7. Sprayed with K_2O at rate 0.6 %

8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

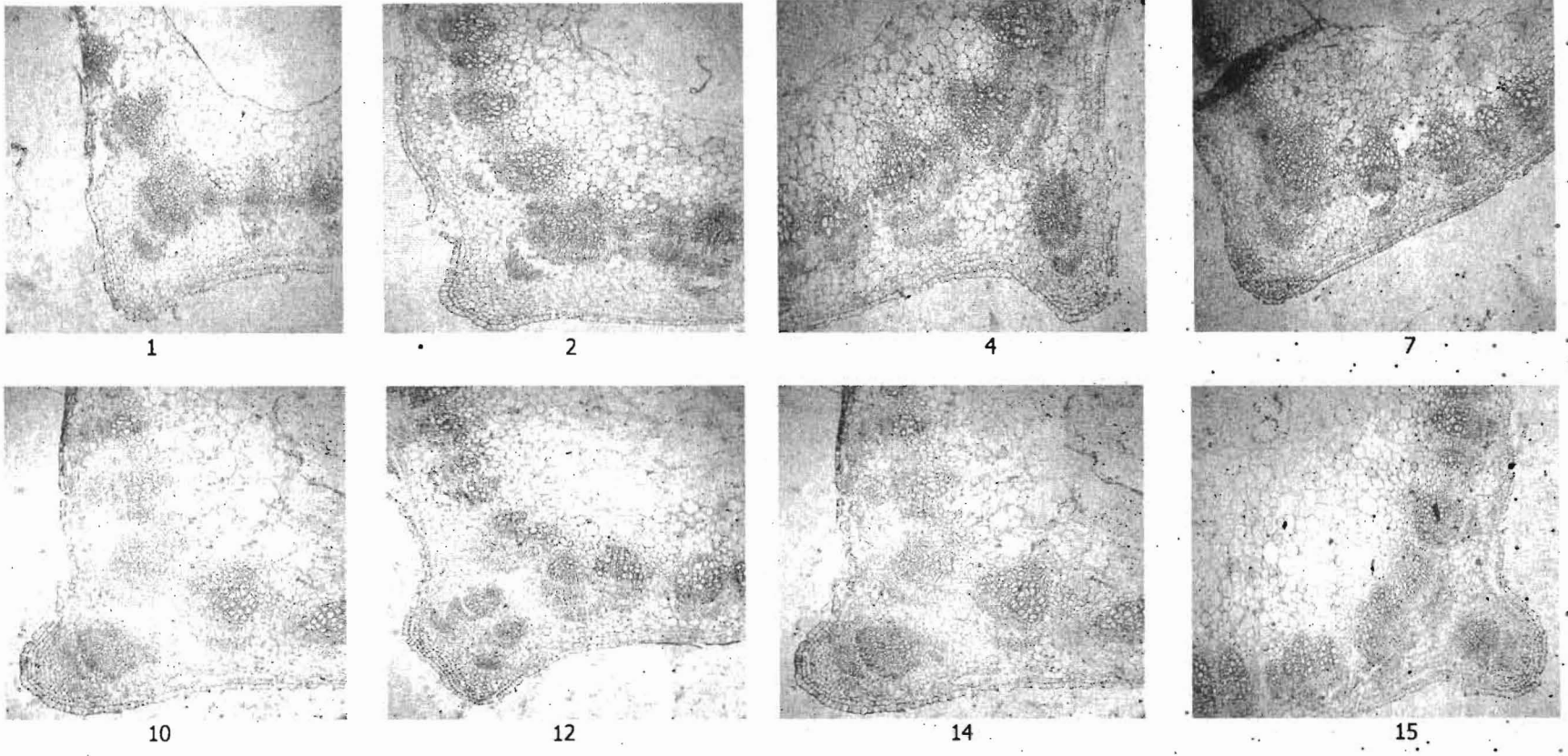
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Table 6. Anatomical characteristics of *vicia faba*, L. leaf sprayed with potassium, zinc and *Artemisia inculta* extract throughout seasons 2006 - 2007 and 2007 - 2008.

Characters Treatments	Midvien thickness (µ)	Midvein width (µ)	Midvein vascular bundle thick. (µ)	Midvein vascular bundle width (µ)	Blade thick (µ)	Spongy tissue thickness (µ)	No. of xylem arms
1	774	823	202	115	381	158	3
2	864	944	321	171	351	180	3
3	1045	857	223	173	475	291	4
4	959	831	248	132	492	331	3
5	965	958	210	201	570	285	5
6	978	902	271	178	544	290	5
7	1157	989	262	175	427	246	4
8	1046	955	382	98	505	300	8
9	795	1007	399	116	454	241	4
10	1010	943	363	175	510	268	4
11	1013	1159	316	175	483	274	7
12	969	1086	421	278	513	257	6
13	1253	1230	359	241	714	457	5
14	988	1321	350	210	500	356	6
15	1051	976	314	256	640	401	7

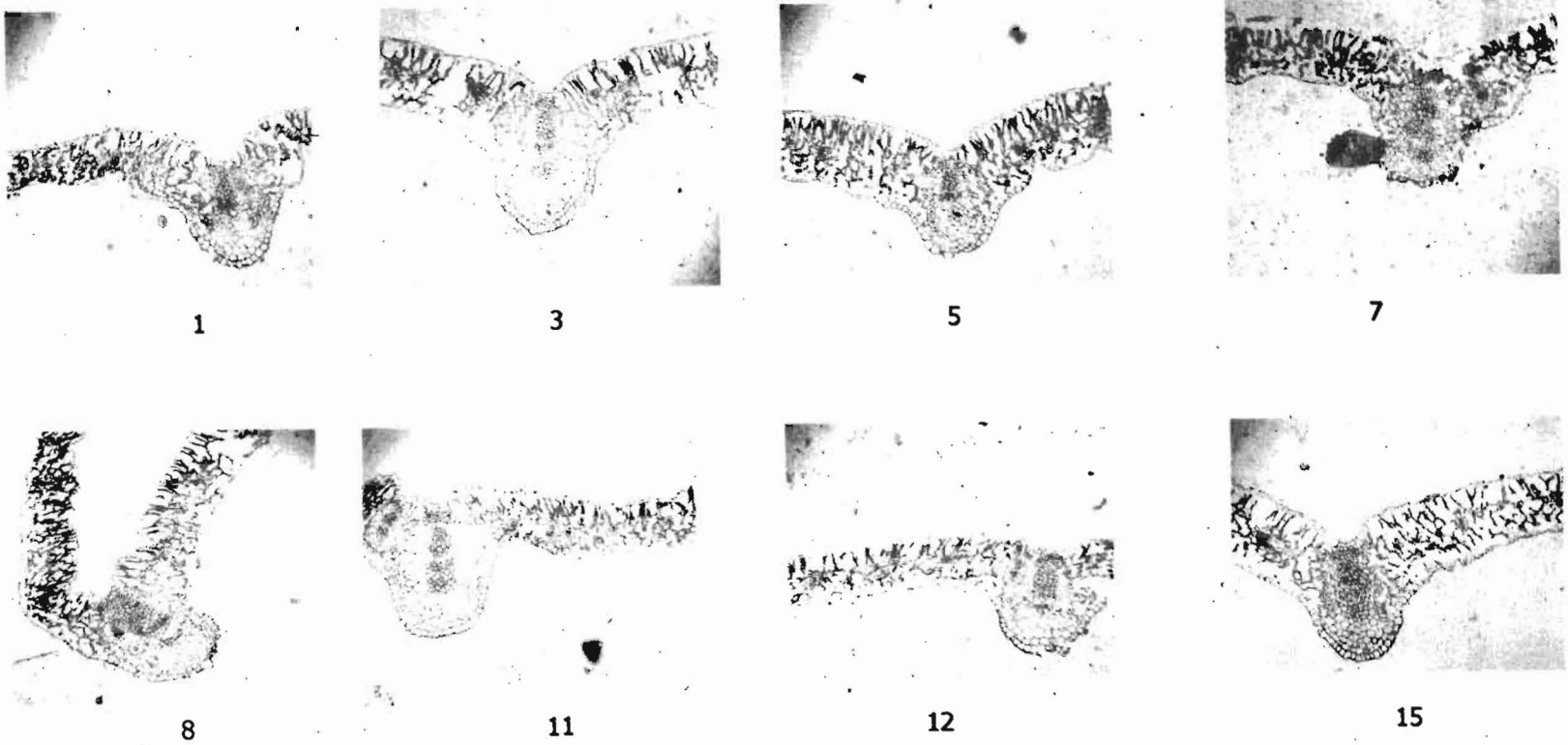
1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm 3. Sprayed with zinc at rate 200 ppm
4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 6. Sprayed with K_2O at rate 0.3 % 7. Sprayed with K_2O at rate 0.6 %
8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
9. Sprayed with 100 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
13. Sprayed with 200 ppm zinc + 0.3 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Fig. 1: Anatomical stem structure



1. Control (sprayed water) 2. Sprayed with zinc at rate 100 ppm
4. Sprayed with *Artemisia inculta* extract at rate 5 cm^3/liter 7. Sprayed with K_2O at rate 0.6 %
10. Sprayed with 100 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
14. Sprayed with 200 ppm zinc + 0.6 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

Fig.2: Anatomical leaf structure



1. Control (sprayed water) 3. Sprayed with zinc at rate 200 ppm 5 cm^3/liter
8. Sprayed with 100 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter
12. Sprayed with 200 ppm zinc + 0.3 % K_2O + 5 cm^3 *Artemisia inculta* extract/liter

5. Sprayed with *Artemisia inculta* extract at rate 10 cm^3/liter 7. Sprayed with K_2O at rate 0.6 %
11. Sprayed with 100 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter
15. Sprayed with 200 ppm zinc + 0.6 % K_2O + 10 cm^3 *Artemisia inculta* extract/liter

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أثر الرش بالبوتاسيوم والزنك ومستخلص الشيح البلدى على الازهار والعقد والتركيب التشريحى لنباتات الفول الرومى

طه بغدادى على[1] ، جلال سرور عبدالحميد عيسى[2] ، احمد احمد خلف الله[3]

١. قسم بحوث الخضر – معهد بحوث البساتين– مركز البحوث الزراعية
٢. قسم النبات الزراعي وأمراض النبات – كلية الزراعة – جامعة الزقازيق
٣. قسم النبات – كلية البنات للاداب والعلوم والتربية – جامعة عين شمس

أجرى هذا البحث في موسمي ٢٠٠٦ – ٢٠٠٧ ، ٢٠٠٧– ٢٠٠٨ على الفول الرومى صنف قصاصين١ لدراسة تأثير الرش بالبوتاسيوم بمعدل ٠,٣ و ٠,٦ % بو٢ أ، والزنك بمعدل ١٠٠ و ٢٠٠ جزء فى المليون، ومستخلص الشيح البلدى بمعدل ٥ و ١٠ سم^3 /لتر ومختلف معاملات التوافيق بينهم في مرحلة النمو الخضرى ونشأة الأزهار على النمو والازهار والمحصول ومكوناته والتركيب التشريحي.

اظهرت كل مواد الرش زيادة معنوية فى النمو الخضرى والازهار والعقد وكمية وجودة المحصول والتركيب التشريحى مقارنة بمعاملة الكنترول.

أدى رش النباتات بمستخلص الشيح البلدى بمعدل ٥ او ١٠ سم^3 /لتر الى زيادة النمو الخضرى (ارتفاع النبات، عدد الاوراق والافرع/نبات، الوزن الجاف/نبات) والمحصول ومكوناته (طول القرن، وزن القرن، عدد القرون/نبات، محصول القرون/فدان) والازهار والعقد وجوده المحصول اكثر من الرش بالبوتاسيوم أو الزنك، فى حين كان للبوتاسيوم تأثير أعلى من تأثير الزنك على الصفات المدروسة ، فيما يتعلق بتأثير مواد الرش على التركيب التشريحى للساق والورقة، فأن النتائج اوضحت تأثير ايجابى للرش بتلك المواد على كل الصفات التى تم دراستها.

وعموما، أظهر رش نباتات الفول الرومى بمخلوط من البوتاسيوم والزنك ومستخلص الشيح البلدى عند كل التركيزات المختلفة زيادة معنوية فى النمو الخضرى والازهار والعقد وكمية وجودة المحصول والتركيب التشريحى عن الرش باى منهم منفردا او الكنترول.