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# EFFECT OF LEAVE FERTILIZER (SUPER GROW) AS ALONE OR COMBINED WITH (NPK) ON GERANIUM ( *Pelargonium graveolenus* L.).

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## ABSTRACT

An experimental field was conducted through two seasons for indicating the effect of(super grow) fertilizer as a foliar application as alone or combined with (NPK ). Super grow at ( 0.17, 0.34, 0.51 and 0.68 gm/l ) single and combined with 80, 60% , 40% and 20 % of recommended (NPK) the same order, meanwhile recommended NPK was used as a control. At the first cut through the two seasons, the treatment of (0.17g super grow/l +80 % recommended ( NPK ) ) revealed the high value of herb/ plant and highest of essential oil. The highest value of citronellol which is the main component of geranium volatile oil was noticed with ( 0.68g super grow/l + 20 % recommended NPK ) compared to control (NPK) only.

## INTRODUCTION

*Pelargonium graveolenus* (L). is one of the most important among essential oil plants considered most expensive one for its properties which make it an ordered in wild world according to its uses in the wild main factory such as medicinal, pharmaceutical and food industry.

It is known that each N,P and K plays important roles in the physiological processes which in turn affect the yield of plant. Whereas, nitrogen is present in chlorophyll molecule and is a component of all proteins. phosphorus is important for enzyme system, and have a vital role in the metabolism, also it is a constituent of nuclear proteins. Whereas potassium is necessary for carbohydrate and protein manufacture. Finally it could be concluded that the NPK cause an increase in yield of plant. Many investigators have cleared the importance of chemical fertilization for plants ( Mandour *et al*., 1980, Selim *et al*. [ 1993 a and b ] and Sawan and Rizk, 1998).On the other hand micro elements have an important roles in the yield of plants too, Possingham ( 1956 ), and Perur *et al*. ( 1961 ) have observed that in Fe deficiency, the protein fraction decreases simultaneously with an increase in the level of soluble organic N compounds. In biochemical functions, Lehninger ( 1975 ) assumed that Mn ion species bridge ATP with the enzyme complex ( phosphokinase and phosphotrans ferase ). Zn is closely involved in the N-metabolism of plant. Price *et al*. ( 1972 ) cited a number of references indicated that the earliest possible casual event of zn defieciency was a sharp decrease in the levels of RNA synthesis leaded to an inhibition of protein formation.

Foliar application has been considered very efficient and economic for crop plants among of various methods of supplemental application (Kannan , 1986, Mohammed,1989 and Khan *et al*. 1992 ). Super grow is shelated leaf fertilizer (20-20- 20), it is used by foliar application on leaves for

getting on greatest yield and repairs the difency of micro nutrients decrease for plant nutrition. Its constituents are total nitrogen 20%, available phosphoric acid ( $P_2O_5$ ) 20%, and soluble potash ( $K_2O$ ) 20%, meanwhile it contains shelated micro elements with Fe 0.15%, Zn 0.15 %, Mn 0.05%, cu 0.05%, ca 0.05%, Mo 0,005% Bo 0.02% and sulpher 0.20%.

This investigation aims to evaluate the effect of super grow fertilizer (foliar spray ) as alone or combined with NPK on the yield , essential oil yield and its constituents.

## MATERIALS AND METHODS

A field experiment was conducted at the experimental station of N. R.C., Shalakan, Kalubia Governorate during two successive seasons (1997 - 1998). In a complete randomized block design of four replicates, terminal cuttings were cultivated in October. The plots area were 10 m2, with 5 rows, with the distance between plants was 25 cm. The experimental plots had nine treatments which were arranged as the followings :

1- 0.17 g ( super grow )/L.
2- 0.34 g ( super grow )/ L.
3- 0.51 g ( super grow )/ L.
4- 0.68 g ( super grow )/ L.
5- 0.17 g ( super grow )/L + 80% recommended ( NPK).
6- 0.34 g ( super grow )/L + 60% recommended ( NPK).
7- 0.51 g ( super grow )/L + 40% recommended ( NPK).
8- 0.68 g ( super grow )/L + 20% recommended ( NPK).
9- Recommended NPK ( 208 kg super phosphate, 292 kg ammonium sulphate and 50 Kg potassium sulphate/fed.

The previously percentages of NPK were added as the following mention, super phosphate as a source of phosphorus was added before sowing to the soil, and other chemical fertilizers ( ammonium sulphate and potassium sulphate ) were divided to two portions, the first one was added after one and half month from sowing., and the second one added after the first cut. Meanwhile foliar applications were sprayed twicely, first one after one and half month from sowing and the second one was after two weeks from the first cut. Plants were cut twice, the first one at March and the second one at June in both seasons, plant height, number of branches/ plant and the herb fresh weight/plant were recorded.

For phytochemical, determination of essential oil content of fresh herbage ( air dried for 72 hr from harvesting time ) was carried out by the water distillation method (Guencher, 1961) on herbage fresh weight. Essential oil constituents were determined; samples of volatile oil were collected from each treatment and dehydrated over sodium sulphate anhydrous, then subjected to GLC analysis with Varian VISTS 6000 FTD model. The separation was carried out with 2m x 1/8u stainless steel, 3% OV-101 column. The flow rate or carrier gas ( nitrogen ) was maintained at 50 l/min. The column temprature was programmed from 80 to 200° c at the rate of 4°c / min. The injection part; temperature was maintained at 180° c and

detector at 240°c. The relative percent of the different compounds was determined by Varian 4270 integrator, and the identification of the separated matching compounds was achived by matching the retention times of these compounds with those of standard compounds under the same conditions.

The data were subjected to statistical analysis according to Snedecor and Cochran ( 1969 ).

**Table ( A ) : Mechanical and chemical analyses of the experimental soil.**

| | |
|---|---|
| **Mechanical analysis :** | |
| clay | 61.9% |
| sand | 11.3% |
| silt | 26.7% |
| texture | clay |
| **Chemical analysis :** | |
| pH | 8.89 |
| E.C. | 1.05 mmhos/cm |
| Ca | 0.93 mg/100gm |
| N | 0.31 ppm |
| P | 0.03 ppm |
| K | 109 mg/100 gm |
| Mg | 1.64 mg/100 gm |
| Na | 3.54 mg/100 gm |
| Fe | 1.39 ppm |
| Mn | 4.01 ppm |
| Zn | 2.32 ppm |

## RESULTS AND DISCUSSION

**1- Vegetative growth :**

Table (1) indicated that both of 0.51 ( super grow )/L + 40% NPK and 0.68g ( super grow )/L + 20% NPK gave the highest value of plant height, but the greatest weight of herbage fresh yield/ plant was noticed with 0.17g (super grow)/L + 80% NPK ( 65.46% ) over control, then with 0.68g ( super grow )/L + 20% NPK ( 51.16%), followed by 0.51g ( super grow )/L+ 40% NPK and the least was 0.34g ( super grow )/L + 60% NPK . Meanwhile the best application of foliar sprays was 0.34g ( super grow ) /L., followed by 0.51g (super grow)/L., then both of 0.17g and 0.68g ( super grow )/L. which gave a resemble results, ( 37.91%, 28.42% and 10.83% ) respectively, over control, these increases were significant. Meanwhile the second cut gave a different trends for plant height and herbage fresh weight; the highest value of plant height resulted by 0.17g ( super grow )/L, followed by 0.68g ( super grow ) / L, then 0.51g ( super grow)/L and finally with 0.34g ( super grow )/L (93.06%, 78.68%, 65.71% and 60.74% ) respectively over control, that is for foliar spray applications which indicated a better effect than their combination with NPK fertilizer ,the lowest increase was observed with 0.34g (super grow )/L + 60% NPK, but 0.51g ( super grow )/L + 40% NPK caused the same value yield of fresh herbage/plant.

**Table (1) : Effect of ( super grow ) fertilizer as foliar spray as alone or combined with ( NPK ) on growth characters of Geranium plants at the first season**

| Characters / Treatments | First cut | | | Second cut | | |
|---|---|---|---|---|---|---|
| | Plant height (cm) | No. of branches/ plant | Fresh yield/ plant (g) | Plant height (cm) | No. of branches | Fresh yield/ plant (g) |
| 0.17g ( super grow)/L | 54. 66 | 3.33 | 102.33 | 39.00 | 7.33 | 106.57 |
| 0.34g ( super grow)/L | 58.33 | 4.00 | 127.33 | 29.33 | 6.66 | 88.73 |
| 0.51g ( super grow)/L | 57.00 | 3.33 | 118.57 | 36.33 | 6.33 | 91.47 |
| 0.68g ( super grow)/L | 54.66 | 3.66 | 101.07 | 39.33 | 6.33 | 98.63 |
| 0.17g ( super grow)/L+ 80% of recommended (NPK ) | 60.66 | 4.00 | 152.77 | 33.33 | 7.66 | 74.33 |
| 0.34 g ( super grow)/L+ 60% of recommended (NPK ) | 63.66 | 4.33 | 136.30 | 33.67 | 6.66 | 61.20 |
| 0.51g ( super grow)/L+ 40% of recommended (NPK ) | 67.00 | 5.66 | 139.30 | 35.00 | 6.33 | 56.03 |
| 0.68g ( super grow)/L+ 20% of recommended (NPK ) | 67.00 | 4.00 | 139.57 | 39.33 | 8.00 | 91.05 |
| Recommended (NPK ) | 63.66 | 4.00 | 92.33 | 38.66 | 6.00 | 55.20 |
| L.S.D. at 0.05 | N.S | N.S | 9.65 | N.S | N.S | 14.53 |

**Recommended (NPK ) = 208 ( KG ) super phosphate, 292 ( KG) ammonium sulphate and 50 ( KG ) potassium sulphate / Fed.**

Table (2) showed that growth character of the two cuts during second season. It was noticed that first cut gave the same trend of first season with a little differences, the increases were very close according the combination treatments and so on the applications of foliar sprays, the greatest increase was 65.21%, significantly over control for 0.17g ( super grow )/L + 80% NPK treatment. Minimum concentration of foliar sprays ( 0.17g [super grow]/L ) resulted the highest value ( 82.17% ) over control, but 0.51g ( super grow )/l + 40% NPK resulted a nearly yield of control fresh herbage/plant.

Meanwhile nomber of branches was not affected by applied treatments through the two seasons at any cut.

In conclusion, it may be noticed that all treatments indicated the same trend through first and second cut during the two seasons, the best results were obtained with combination treatments for both plant height and herbage fresh yield /plant in the first cut, meanwhile the best results were obtained by foliar spray applications in the second cut.

The present data are in harmony with those cited by many investigators, Duraisamy *et al.* ( 1990 ), they indicated that foliar feeding of micronutrients on bergamot mint ( Mentha citrata ) resulted in the greatest plant height and highest herbage yields at both harvest(first and second cut ). Czuba ( 1994 ) reprinted that foliar application of trace elemants or nitrogen combined with trace elements; foliar applications of Insol- 3, which contains N ,Mg, B, Cu, Mn, Zn and Fo gave the largest yield of winter wheat , winter barley, winter triticale and rye. Subbaiah and Mittra ( 1996 ), showed that foliar spray of micro nutrients ( Zn, B and Mo ) as alone or combined with recommended NPK increased the seed yield of indian mustard ( Brassica juncea ) and finally Youssef *et al.* ( 2000 ) cited that foliar fertilzation contains

ally lsulfide, p, k, Mg, Ca and Fe increased plant height and herbage fresh weight in both of two cuts of Geranium plants (pelargonium graveolenus l.).

**Table (2) : Effect of ( super grow ) fertilizer as foliar spray as alone or combined with ( NPK ) on growth characters of Geranium plants at the second season**

| Characters / Treatments | First cut | | | Second cut | | |
|---|---|---|---|---|---|---|
| | Plant height (cm) | No. of branches/ plant | Fresh yield/ plant (g) | Plant height (cm) | No. of branches | Fresh yield/ plant (g) |
| 0.17g ( super grow)/L | 56.33 | 4.33 | 105.34 | 41.33 | 6.33 | 104.57 |
| 0.34g ( super grow)/L | 60.77 | 5.00 | 119.66 | 40.66 | 5.66 | 90.07 |
| 0.51g ( super grow)/L | 58.33 | 4.00 | 108.59 | 37.33 | 5.33 | 94.58 |
| 0.68g ( super grow)/L | 56.33 | 4.33 | 100.19 | 40.66 | 5.33 | 100.03 |
| 0.17g ( super grow)/L+ 80% of recommended (NPK ) | 61.33 | 4.00 | 154.39 | 34.33 | 6.33 | 77.43 |
| 0.34 g ( super grow)/L+ 60% of recommended (NPK ) | 64.33 | 4.66 | 140.03 | 33.66 | 7.00 | 59.87 |
| 0.51g ( super grow)/L+ 40% of recommended (NPK ) | 68.66 | 6.33 | 143.15 | 35.33 | 5.66 | 58.09 |
| 0.68g ( super grow)/L+ 20% of recommended (NPK ) | 68.33 | 4.66 | 145.36 | 40.33 | 8.33 | 95.09 |
| Recommended (NPK ) | 64.33 | 4.33 | 93.45 | 39.33 | 6.33 | 57.40 |
| L.S.D. at 0.05 | N.S | N.S | 10.12 | N.S | N.S | 15.45 |

**Recommended (NPK ) = 208 ( KG ) super phosphate, 292 ( KG) ammonium sulphate + 50 ( KG ) potassium sulphate / Fed.**

**Essential oil percentage and yield :**

Table (3) revealed the effect of all treatments on essential oil percentage and yield during the first season. All treatments increased essential oil percentage and yield significantly, since highest value of essential oil percentage was obtained with 0.17 ( super grow )/L., but the greatest value of volatile oil yield/ plant and per feddan was noticed with 0.17g ( super grow )/L + 80% NPK.100.0% and 100.2% over control respectively, meanwhile the minum increase resulted by 0.68g ( super grow)/L. + 20% NPK, that for first cut. All treatments caused an increment in volatile percentage and yield, but the increment in volatile oil/ plant was insignificant in the second cut. Application of 0.17g ( super grow )/L. gave the highest value of volatile oil percentage and yield.

**Table (3) : Effect of ( super grow ) fertilizer as foliar spray as alone or combined with ( NPK ) on volatile oil percentage and yield of Geranium plants at the first season**

| Characters / Treatments | First cut | | | Second cut | | |
|---|---|---|---|---|---|---|
| | % | Yield / plant ( ml. ) | yield / fed ( L. ) | % | Yield / plant ( ml. ) | yield / fed ( L. ) |
| 0.17g ( super grow)/L | 0.32 | 0.33 | 7.28 | 0.27 | 0.29 | 6.42 |
| 0.34g ( super grow)/L | 0.29 | 0.37 | 8.19 | 0.24 | 0.22 | 4.87 |
| 0.51g ( super grow)/L | 0.31 | 0.38 | 8.41 | 0.26 | 0.24 | 5.31 |
| 0.68g ( super grow)/L | 0.28 | 0.29 | 6.42 | 0.23 | 0.23 | 5.09 |
| 0.17g (super grow)/L+ 80% of recommended (NPK ) | 0.30 | 0.46 | 10.19 | 0.25 | 0.19 | 4.21 |
| 0.34 g ( super grow)/L+ 60% of recommended (NPK ) | 0.30 | 0.41 | 9.08 | 0.25 | 0.15 | 3.32 |
| 0.51g ( super grow)/L+ 40% of recommended (NPK ) | 0.25 | 0.35 | 7.74 | 0.21 | 00.10 | 2.22 |
| 0.68g ( super grow)/L+ 20% of recommended (NPK ) | 0.24 | 0.34 | 7.53 | 0.20 | 0.18 | 3.99 |
| Recommended (NPK ) | 0.22 | 0.23 | 5.09 | 0.18 | 0.10 | 2.21 |
| L.S.D. at 0.05 | 0.027 | 0.059 | 1.43 | 0.019 | N.S | 0.14 |

**Recommended (NPK ) = 208 ( KG ) super phosphate, 292 ( KG) ammonium sulphate and 50 ( KG ) potassium sulphate / Fed.**

Table (4) presented the effect of applied treatments on volatile oil percentage and yield at the second season. It was appeared that the two cuts showed the same trend of first season, except of the increase was 126.32% and 126.13% over control respectively for volatile oil yield/plant and feddan through the first cut, All treatments showed the same trend at the second cut of first season too, but the increment of volatile oil/plant was insignificant.

Obtained results are in agreement of those which cited by many invistigators, such as Kocourkova and Vrzalova ( 1992 ) on Mentha piperita, Hussien *et al.* ( 1996 ) on Lavender, Khattab and Omer ( 1999 ) on some Apiaceae plants and Youssef *et al* ( 2000 ) on Pelargonium graveolenus L.

**Essential oil compositions :**

Regarding to table (5) it was found that citronellol is the major component followed by geraniol, total hydrocarbons were arranged from 0.071% to 5.568 according to applied treatments, in addition foliar sprays revealed the highest values of total hydrocarbons percentage ( $\alpha$ - pinene, P – pinene and myrcene ). Meanwhile combined treatments gave the lowest values of total hydrocarbons under control except of 0.34g ( super grow )/L. + 60% NPK which gave a higher value over control ( NPK ), only. Foliar spray applications at low concentrations ( 0,17g and 0.34g /L. ) increased citronellol , but high concentrations ( 0.51 g and 0.68g /L. ) decreased it. Whereas combined treatments of high concentrations with low percentage of recommended NPK increased citronellol, meanwhile low concentrations of foliar sprays combined with high percentage of NPK caused a decrease in it.

Geraniol was increased with foliar spray applications except of 0.34g/L , and it was decreased with combined treatments except of 0.51g/L+ 40% NPK which gave a nearly value of control.

**Table (4) : Effect of ( super grow ) fertilizer as foliar spray alone or combined with ( NPK ) on volatile oil percentage and yield of Geranium plants at the second season**

| Characters / Treatments | First cut | | | Second cut | | |
|---|---|---|---|---|---|---|
| | % | Yield / plant ( ml. ) | yield / fed ( L. ) | % | Yield / plant ( ml. ) | yield / fed ( L. ) |
| 0.17g ( super grow)/L | 0.31 | 0.33 | 7.31 | 0.26 | 0.27 | 5.98 |
| 0.34g ( super grow)/L | 0.28 | 0.34 | 7.53 | 0.23 | 0.21 | 4.65 |
| 0.51g ( super grow)/L | 0.30 | 0.33 | 7.41 | 0.24 | 0.23 | 5.09 |
| 0.68g ( super grow)/L | 0.29 | 0.30 | 6.64 | 0.23 | 0.24 | 5.31 |
| 0.17g ( super grow)/L+ 80% of recommended (NPK ) | 0.28 | 0.43 | 9.52 | 0.24 | 0.19 | 4.21 |
| 0.34 g ( super grow)/L+ 60% of recommended (NPK ) | 0.29 | 0.41 | 9.08 | 0.25 | 0.15 | 3.32 |
| 0.51g ( super grow)/L+ 40% of recommended (NPK ) | 0.26 | 0.37 | 8.19 | 0.22 | 0.11 | 2.44 |
| 0.68g ( super grow)/L+ 20% of recommended (NPK ) | 0.25 | 0.36 | 7.97 | 0.21 | 0.20 | 4.43 |
| recommended (NPK ) | 0.20 | 0.19 | 4.21 | 0.15 | 0.09 | 1.99 |
| L.S.D. at 0.05 | 0.025 | 0.050 | 1.29 | 0.017 | N.S | 0.12 |

**Recommended (NPK ) = 208 ( KG ) super phosphate, 292 ( KG) ammonium sulphate and 50 ( KG ) potassium sulphate / Fed.**

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## تـأثير السـماد الـورقى المخلبـى سـوبر جـرو إمـا منفـردا أو مجتمعـا مـع السـماد الكيمياوى ( NPK ) على نبات العتر

**محمد سيد على محمد و نبيلة يحيى محمد نجيب**

**قسم زراعة وإنتاج النباتات الطبية و العطرية – المركز القومى للبحوث – الدقى القاهرة – مصر.**

تم إجراء تجربة حقلية خلال موسمين متتاليين وذلك لدراسة تأثير كل من السماد الورقى سوبر جرو منفردا أو مجتمعا مع بعض نسب السماد الكيماوى النتروجينى ، الفوسفورى ، البوتاسى الموصى به على نباتات العتر. وقد أوضحت النتائج أن أقل تركيز من السماد الورقى (٠,١٧جم/لتر ) مضافا إليه ٨٠% من السماد الكيماوى الموصى به أعطت أعلى زيادة فى كلا من طول النبات والوزن الطازج للعشب وكذلك أعلى نسبة لمحصول الزيت الطيار . بينما أعطى التداخل بين ٠,٦٨ جم ( سوبر جرو )/ لتر مع ٢٠% من السماد الكيماوى الموصى به أعلى نسبة من مركب السيترونيللول ( المكون الرئيسى لزيت العتر ) وأعطت المعاملة ٠,٥١ جم ( سوبر جرو )/ لتر أعلى نسبة من الجرانيوم وهو المركب التالى لمركب السيترونيللول من حيث المكونات للزيت الطيار للعتر.

**Table (5) : Effect of ( super grow ) fertilizer as foliar spray as alone or combined with ( NPK ) on essential oil composition of Geranium plants.**

| Treatments / Compounds | 0.17g super grow/L. | 0.34g super grow/L | 0.51g super grow/L | 0.68g super grow/L | 0.17g super grow/L + 80% rec.NPK | 0.34g super grow/L+ 60% rec.NPK | 0.51g super grow/L + 40% rec.NPK | 0.68g super grow/L+ 20% rec.NPK | Rec. NPK |
|---|---|---|---|---|---|---|---|---|---|
| α- Pinene | 0.015 | 0.001 | 0.056 | 0.504 | 0.002 | 0.027 | 0.007 | 0.004 | 0.015 |
| B- Pinene | 0.070 | 0.063 | 0.067 | 0.072 | 0.064 | 0.011 | 0.007 | 0.014 | 0.628 |
| Myrcene | 5.292 | 5.655 | 1.889 | 0.008 | 0.863 | 3.105 | 0.105 | 0.053 | 1.938 |
| Limonene | 11.141 | 12.396 | 19.655 | 14.722 | 11.884 | 12.073 | 12.358 | 14.008 | 12.480 |
| p-cymene | 0.121 | 0.011 | 0.053 | 0.047 | 0.015 | 0.580 | 0.851 | 0.322 | 0.650 |
| Isomenthone | 1.806 | 0.810 | 1.278 | 0.009 | 4.890 | 4.530 | 1.101 | 1.418 | 4.231 |
| Linalool | 0.551 | 0.606 | 7.560 | 7.259 | 4.669 | 10.288 | 4.860 | 1.590 | 5.100 |
| Citronellol | 58.529 | 59.438 | 26.163 | 36.551 | 54.723 | 50.894 | 57.578 | 61.158 | 55.600 |
| Nerol | 0.856 | 0.554 | 1.822 | 1.403 | 1.013 | 0.437 | 0.533 | 0.827 | 0.720 |
| Citronellyl butyrat | 0.116 | 0.863 | 1.234 | 1.083 | 1.098 | 0.413 | 0.379 | 0.871 | 1.436 |
| Geraniol | 4.331 | 9.646 | 25.263 | 12.647 | 10.143 | 9.654 | 11.695 | 8.447 | 11.073 |
| Carvon | 4.319 | 3.695 | 4.951 | 10.585 | 4.580 | 4.365 | 4.321 | 4.440 | 3.322 |
| Phenyl ethyl isobutrale | 0.265 | 0.644 | 1.916 | 4.443 | 3.219 | 2.592 | 3.473 | 1.335 | 0.600 |
| Citronellyl formate | 0.169 | 0.741 | 0.330 | 0.827 | 0.766 | 0.289 | 0.874 | 1.085 | 0.668 |
| Geranyl butyrate | 0.306 | 0.564 | 0.738 | 0.677 | 0.337 | 0.278 | 0.173 | 0.871 | 1.042 |
| Geranyl hexanoate | 1.985 | 2.714 | 5.749 | 5.887 | 0.534 | 0.279 | 1.017 | 2.960 | 0.477 |
| Geranyl tiglate | 0.013 | 0.034 | 0.993 | 0.829 | 0.594 | 0.140 | 0.648 | 0.508 | 0.046 |
| Eugenol | 0.113 | 0.179 | 0.284 | 0.201 | 0.354 | 0.039 | 0.023 | 0.186 | 0.024 |
| Phenylethyl tiglate | ----- | 0.256 | -- | 0.660 | 0.110 | 0.008 | - | 0.097 | - |

**Recommended ( NPK )= 208 ( Kg ) super phosphate, 292 ( Kg ) ammonium sulphate and 50 ( Kg ) potassium sulphate / fed .**