

# Full report

To compare the potassium-absorption rate of Nutri Gold – K  
and others

by

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## Abstract

The study of comparing the potassium-absorption rate of Nutri Gold – K and others by foliar application on tomato (*Solanum lycopersicum*) was located in green house at faculty of Agricultural and Plant Production, Maejo University, Chiang Mai, Thailand. Seven treatments were laid out in a completely randomized design (CRD) with three replications consist of 1) control, 2) Nutri Gold - K (Liquid potassium acetate), 3) Potassium sulfate, 4) Potassium Chloride, 5) Liquid potassium carbonate, 6) Liquid potassium citrate and 7) Potassium Nitrate. The result showed that Nutri Gold – K form significantly caused the highest absorption total potassium in tomato-leaf comparing with others especially in 12-72 hours after spraying. Whereas Liquid potassium carbonate and Liquid potassium citrate provided the second record at 12 and 24 hours after foliar application without non-significant. All treatments were not significant among treatments at 96 and 144 hours after foliar application.

## Introduction

TNA Group, a Dutch – Thai Joint venture company, who specializes in the design and manufacturing of high quality foliar fertilizers and other products for the agricultural and horticultural industries. TNA is committed to research and produce innovative products for the Asian and Middle Eastern regions by combining knowledge and technologies from the Netherlands and Europe with manufacturing facilities in Thailand. TNA Group was founded in 2005 and was successful in supplying over 100 domestic customers in Thailand, then in 2016 TNA International was founded together with investors from the Netherlands. TNA Group has expanded to Myanmar, Vietnam, Nepal and India and strives to continue to grow and expand into the rest of Asia and the Middle East.

For the new main product such as foliar fertilizers, crop protection, foliar enhancer etc. are presented. Nutri Gold – K is the new product that has potassium as main element in form of potassium acetate that we assume in highly absorption comparing other potassium sources in the market share.

## Objective

To study of comparing the potassium-absorption rate of Nutri Gold – K and others by foliar application.

## Materials and Method

### Experimental designed

Tomato (*Solanum lycopersicum*) was selected for studying on this experiment by comparing the rate of absorption of K in leaf-sample. Tomato seeding were growing in peat moss media as one seed per pit with regular watering everyday on the mooring for 30 days after emergency. The 12-15 centimeters height seedings were selected to grow in plastic pot (8 inches) with one plant/pot in green house at faculty of Agricultural and Plant Production, Maejo University, Chiang Mai, Thailand. Completely Randomized Design: CRD was set with 7 treatments and 3 replications (3 pots/replication) consist of 1) control, 2) Nutri Gold - K (Liquid potassium acetate), 3) Potassium sulfate, 4) Potassium Chloride, 5) Liquid potassium carbonate, 6) Liquid potassium citrate and 7) Potassium Nitrate. Nitrogen and phosphorus fertilizer (16-20-0) were treated as soil application with 2.5 gram/pot on the first time. The tomato plants were watered 250 ml/plant/pot everyday on the first week of translocated, then increased the rate of water up to 500 ml/plant/pot when plant age at 3 weeks after translocated.

Potassium foliar fertilizers management were applied when plant getting mature stage or translocated with 30 days. The rate of K-fertilizer was set with 0.15%K in all treatments without only control. The adjuvant was mixed with fertilizer as 0.5 ml/ 1 liter of water. All fertilizers were sprayed only one time at 8.00 a.m. before collecting samples with the exactly time following treatments :

Treatment 1. Control (no foliar apply)

Treatment 2. Nutri Gold - K (Liquid potassium acetate or 3-0-25)

Treatment 3. Potassium sulfate (0-0-50)

Treatment 4. Potassium Chloride (0-0-60)

Treatment 5. Liquid potassium carbonate (0-0-30)

Treatment 6. Liquid potassium citrate (0-0-24)

Treatment 7. Potassium Nitrate (13-0-46)

### Collecting and Analyzing samples

The tomato leaf-sample was collected for total potassium content analysis. The different times as 12, 24, 48, 72, 96, 120 and 144 after spraying fertilizers were estimated for absorption of K in different treatments. The 3-4 leave tomato samples on top of plant with 3 replication/ treatment were collected and dried at 70 degree for 48 hours. The leave tomato samples were grinded and digested with  $\text{HNO}_3$  and  $\text{HClO}_3$  by AOAC method (1975) for measuring the total K by Atomic Absorption Spectrophotometer (GBC-SavantAA, Australia).

## Result

The result of total potassium in tomato leaf samples at 12 hours after spraying showed in the highest at 4.14% with Nutri Gold – K (TRT2) but nonsignificant with liquid potassium carbonate (TRT 5) ( $P < 0.01$ ). Potassium Nitrate caused the lower level of total K compared with other fertilizers. The control treatment showed in the lowest of total potassium at 1.08%K. At 24 hours after treating fertilizers, the total K content was reported at the highest in all treatments. Nutri Gold – K (TRT2) provided significantly the highest level at 4.70%K ( $P < 0.01$ ). While liquid potassium citrate had not significantly different with lower content of total K in leaf samples comparing potassium sulfate, liquid potassium carbonate and potassium nitrate. The averages of total K in all treatments were slightly decreased after 48 hours after foliar application. Moreover, Nutri Gold - K (Liquid potassium acetate) still recorded the total K in higher level but nonsignificant deferring with potassium sulfate and liquid potassium citrate ( $P < 0.01$ ) at 48 hours.

Generally, the total potassium content in tomato leaf gotten down from 72 to 144 after spraying with average scale ranged from 2.07 to 2.44 %K after 72 hours. Interestingly, Nutri Gold - K (Liquid potassium acetate) showed in the highest total potassium content in tomato leaf ( $P < 0.01$ ). The tomato leaf samples at 120 hours were examined in high level (2.76%K) by liquid potassium citrate form without differently potassium chloride. However, it was not significant data of total potassium content in tomato leaf at 96 and 144 hours among treatments (Table 1).

Table 1. The percentage of total potassium in tomato leaf-sample at different times after spraying K-fertilizer forms

Treatment	12 HR <sup>1/</sup>	24 HR	48 HR	72 HR	96 HR	120 HR	144 HR
Control	1.08 d <sup>2/</sup>	1.99 d	2.24 d	1.68 c	1.95	2.09 cd	2.00
Nutri Gold - K	4.14 a	4.70 a	4.01 a	2.87 a	2.79	2.63 ab	2.38
Potassium sulfate	2.85 bc	3.53 bc	3.28 ab	1.75 bc	2.18	2.20 cd	1.73
Potassium Chloride	2.66 bc	3.96 b	3.14 bc	2.27 b	2.35	2.44 abc	2.19
Liquid potassium carbonate	3.30 ab	3.51 bc	3.12 bc	1.92 bc	2.37	2.27 bcd	2.30
Liquid potassium citrate	3.13 b	3.15 c	3.37 ab	1.88 bc	2.62	2.76 a	2.21
Potassium Nitrate	2.08 c	3.63 bc	2.44 cd	2.09 bc	2.79	1.99 d	1.89
<b>Grand mean</b>	<b>2.75</b>	<b>3.50</b>	<b>3.09</b>	<b>2.07</b>	<b>2.44</b>	<b>2.34</b>	<b>2.10</b>
<b>CV</b>	<b>12.95</b>	<b>7.29</b>	<b>10.49</b>	<b>14.68</b>	<b>17.65</b>	<b>10.02</b>	<b>13.81</b>
<b>F-test</b>	<b>**</b>	<b>**</b>	<b>**</b>	<b>**</b>	<b>ns</b>	<b>*</b>	<b>ns</b>

1/ = Hour after spraying fertilizers.

2/ = Values followed by different letter are significantly different according to DMRT.

\* = Significant difference at P< 0.05 level. \*\* = Significant difference at P< 0.051level. ns = Non-significant difference.

Figure 1 and 2 showed the high efficiency of absorption of potassium fertilizers by foliar application at 24 hours. The tendency of K content decreased after 72 hours after spraying. Furthermore, Nutri Gold - K treatment enhanced the highest level of potassium in tomato leaf from 12 to 72 hours compared with other fertilizes. The overall data presented that the highest efficiency of foliar application was recorded in 72 hours. At 96 hours after application, all fertilizer forms were not significantly different comparing with control. The potassium content in tomato leaf might accumulated by potassium ion in soil solution that confirm by K content at 72 hours was showed in nonsignificant.

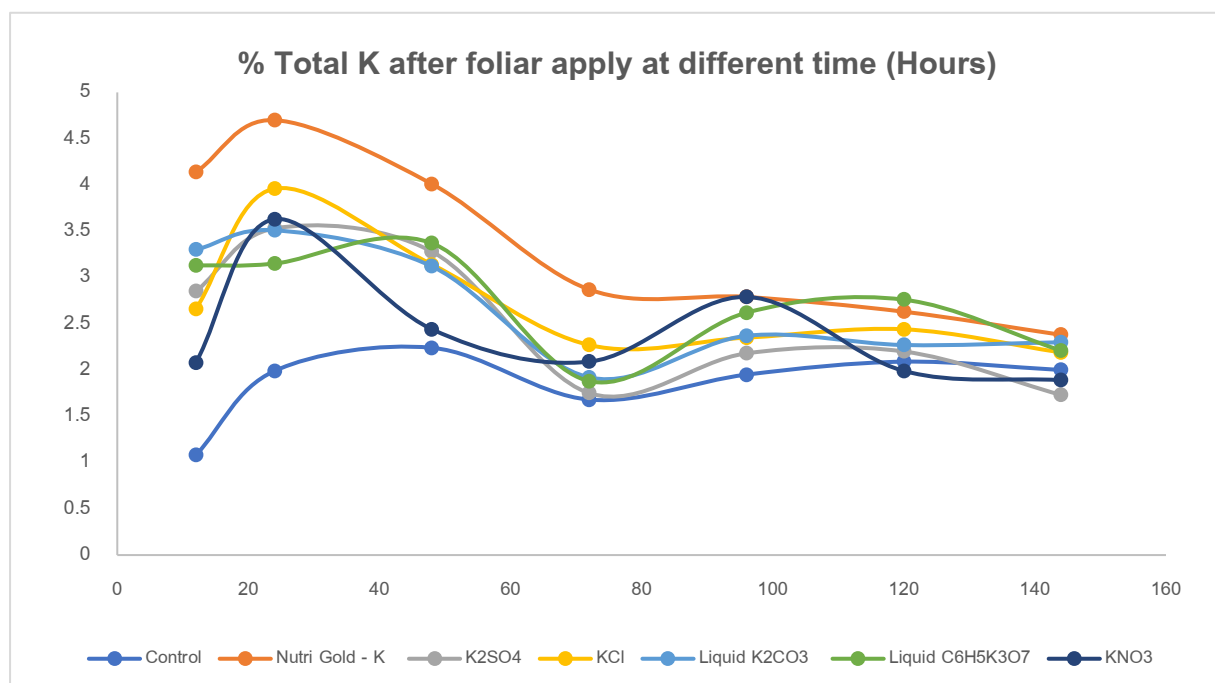


Figure 1. The relation of total potassium in tomato leaf-sample at different times after spraying K-fertilizer forms



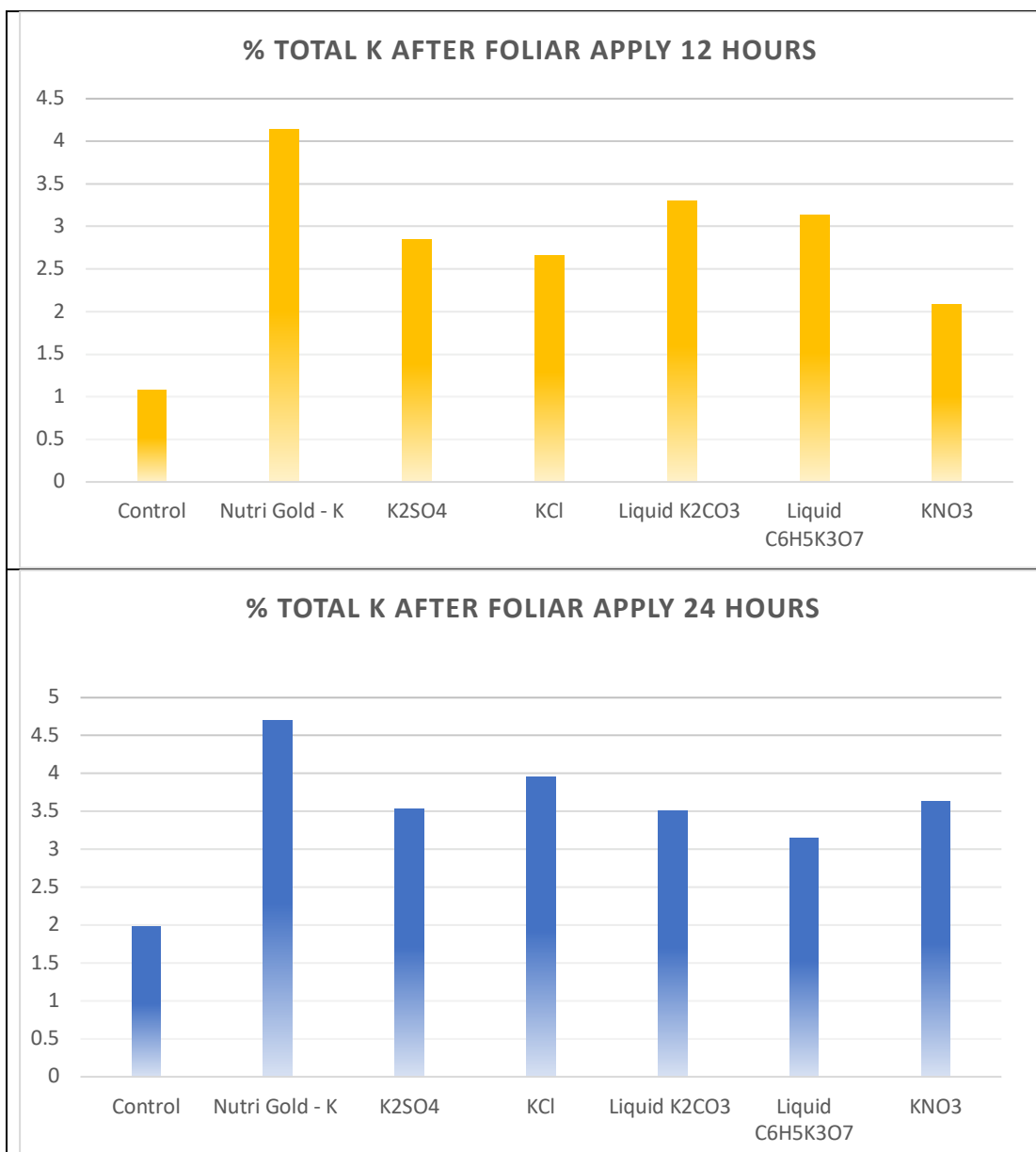


Figure 2. The total potassium in tomato leaf-sample at 12 and 24 hours after spraying K-fertilizer forms

## Discussion

Normally, foliar application aims to increase the essential elements when plants show some nutrients deficiency by soil application. Hence, foliar application is one of the other techniques to improve plant growth with right rate and time. The efficiency of fertilizer by spraying must relate with kind and form of fertilizers though cell membrane. The translocating depends on form of organic or ion sustenance by diffusion pathway that has effect from deliquescence under normal temperature and pressure (Yongyuth, 2014).

This experiment showed that Nutri Gold – K as form of potassium acetate could higher absorb on tomato leaf than other forms. Normally, potassium acetate is good characteristic such as solubility, pH, point of deliquescence, molecular weight, and concentration (Yongyuth, 2014). Potassium acetate is a chlorine free with minimal potential for phytotoxicity and monohydrate ion comparing with potassium sulfate, potassium chloride, potassium carbonate, potassium nitrate and potassium citrate. The result of this experiment showed in the same trend of previous studies for instance the translocation of 14 potassium fertilizers in pea cane showed that potassium in form of bicarbonate, potassium nitrate and some potassium phosphate could higher absorb than other forms. The potassium inorganic form was a positive correlation between total % K absorption and the degree of translocation away from the treated area (Smith et al., 1987; Swietlik and Faust, 1984; Umar et al., 1999; Changwei et al., 2016).

This experiment explains that Nutri Gold – K (Liquid potassium acetate) and potassium citrate could more translocate potassium than other forms especially in 12 hours after applying. Hence, the total potassium of tomato leaf sample was significantly recorded in the highest level. Both of potassium acetate and potassium citrate consist of mixing between organic and inorganic forms that show in good absorption from only inorganic form. Moreover, Warren and Reed (1986) who found that foliar potassium fertilizer in an inorganic form more caused the halo blight in soybean than an organic forms and potassium acetate could show in the highest content of potassium of soybean.

Nutri Gold – K (Liquid potassium acetate) was the highest efficiency on 12-24 hours after treating fertilizer. However, there was no significant after 48 hours compared with other forms. It may cause by the low concentration of K in this experiment at 0.15%K. The amount of potassium ions could translocate to phloem in high rate with

this concentration (Marchner, 1995). Then up to 3-4 days after application, the total potassium content may not differ among treatments. The potassium content in tomato leaf samples may more accumulate from soil solution than foliar application.

### Conclusion

Through this experiment, Nutri Gold – K showed the highest absorption of potassium in form of potassium acetate. Generally, the result of total content of potassium in tomato leaf samples was higher recorded by Nutri Gold – K treatment than other potassium fertilizer-forms at 12-72 hours after spraying. Second, liquid potassium carbonate and liquid potassium citrate gave the same trend at 12 hours after spraying but nonsignificant. However, the total potassium content in leaf sample was not significant among treatments at 96 and 144 hours after fertilizers application.

## References

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## Appendix



Figure 1 Transfer tomato seeding to the pots





Figure 2 Tomato plants at 30 days after transplanting





Figure 3 Spraying potassium fertilizers on the morning before collecting samples





Figure 4 Tomato leaf samples were collected before oven at 70 degree