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# Soil K Status and K Requirement of Potato Growing on Different Soils of Western Amhara

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**Abstract**

An experiment was conducted in 2005/06 and 2006/07 cropping seasons on Nitosols, Acrisols and Luvisols of Western Amhara to investigate the inherent soil K status and K requirement of potato growing on these soils. The field experiments were conducted in Yilmana Densa (West Gojjam Zone), Farta (South Gondar Zone) and Banja (Awi Zone) woredas. Soil samples were collected from experimental sites before planting of potato and analyzed for exchangeable K status. The treatments included in the field experiment were 6 levels of potassium fertilizer (0, 30, 60, 90,150 and 210 kg $K_2O$ $ha^{-1}$) that were arranged in randomized complete block design with three replications. All of the K fertilizer for each treatment was band-applied at planting along and in one side of the rows at a distance of 5 cm below and 5 cm aside the seeds. Muriate of potash (KCl) was used as a source of K. Moreover, 81kg N and 69 kg $P_2O_5$ (recommended rates for western Amhara) were added to all plots. This was done by applying 150 kg DAP and 58.5 kg urea at planting and side dressing 58.5 kg urea at flowering stage. Results of the experiment indicated that there was no significant increase in potato tuber number, plant height, number of main stems per plant, potato dry matter yield due to increase in K fertilizer rate on Nitosols, Acrisols and Luvisols. However, increase in K fertilizer rate significantly increased mean tuber weight and tuber yield of potato on Acrisols of Banja Woreda and improved shelving life of potato collected from all soil types.

**Key words:** Acrisols, Luvisols, Nitosols, Potassium, Potato

## Introduction

Of all the essential elements, potassium is the third most likely crop yield limiting nutrient after nitrogen and phosphorus. It plays a critical role in lowering cellular osmotic water potentials, thereby reducing the loss of water from leaf stomata and increasing the ability of root cells to take up water from the soil. Potassium is also essential for photosynthesis, protein synthesis, nitrogen fixation in legumes and for starch formation and increasing tuber yield (Brady and Weil, 2002). It is also especially important in helping plants adapt to environmental stresses like drought and frost. Nevertheless, this nutrient has received little attention in Ethiopian agriculture. This is mainly because K has been regarded as adequately available nutrient in Ethiopian Soils. Murphy (1963) in his work, which is recognized as the first systematic approach in characterizing the nutrient status of Ethiopian soils, reported that Ethiopian soils have adequate potassium. However, his work lacked adequate data on crop yield response to fertilizers (Taye, 1998). Moreover, more recent information of Mesfin (1998) indicated that Ethiopian Alfisols, as all moderately to intensively weathered soils, have limited amounts of basic rocks that usually contain more easily weatherable potassium, which affects the potassium content of these soils. This situation could be even worse on more weathered and leached Ultisols of Injibara area where potato is widely cultivated

It is also apparent that intensive cropping in the absence of K replenishment would not only lead to "hidden hunger" but also can precipitate diminished productivity. Therefore, preliminary study on potassium status of Nitosols, Acrisols and Luvisols would help to devise strategies for proper soil fertility management. Moreover, studying the K requirement of potato, a crop which is believed to be highly responsive to K application, may play a significant role in improving land productivity and assist the food security endeavors of the region. Therefore, the objective of this study was to assess the potassium status of Nitosols, Acrisols and Luvisols and investigate the K requirement of potato growing on these three soils of western Amhara.

## Materials and Methods

### Determination of Soil K Status

Representative soil samples were collected from Nitosols, Acrisols and Luvisols of western Amhara where potato is intensively cultivated. Exchangeable potassium was determined by extracting potassium with 1*N* $NH_4OA$ and analyzing the K status as outlined in Sahlemedihin and Taye (2000).

### Treatments, experimental design and field lay out

The field experiment was conducted in Yilmana Densa, Farta and Banja woredas representing three soils of western Amhara. The treatments included in the experiment were 6 levels of potassium fertilizer; i.e., 0, 30, 60, 90, 150 and 210 kg $K_2O$ $ha^{-1}$.

The treatments were arranged in randomized complete block design with three replications. The gross plot size of the experimental site was 3.0m x 3.0 m (9.0 $m^2$) and the net plot size was 1.5 m x 2.4 m (3.6 $m^2$). Spacing between rows was 75 cm and between plants was 30 cm. The distance between plots was 0.5 m and between blocks was 1.0 m. A potato variety called "Tolcha" was used in the experiment.

### Fertilizer application and cultural practice

All of the K fertilizer for each treatment was band-applied at planting along and in one side of the rows at a distance of 5 cm below and 5 cm aside the seeds. Muriate of potash (KCl) was used as a source of K. Moreover, 81 kg N and 69 kg $P_2O_5$, recommended rates for western Amhara (personal communication), was added to all plots. This was done by applying 150kg DAP and 58.5 kg urea at planting and side dressing 58.5 kg urea at flowering stage. Weeding and ridging operations were conducted to all plots as necessary.

**Data collection**

Potato tuber number, plant height, number of main stems per plant, mean tuber weight, percent tuber dry matter yield, potato tuber slices shelving life, potato tuber yield were collected. To calculate percent tuber dry matter yield, 5 representative tubers were taken from each plot. The tubers were weighed before and after drying. Then, percent tuber dry matter yield was obtained by dividing the dry matter weight by fresh weight and multiplying the value obtained by 100. To determine the potato tuber slices shelving life, potato tubers were sliced with a sharp blade and exposed for oxidation for 48 hours. Then the dark area percentage of the sliced surface from the total slice area was calculated.

**Statistical Analysis**

Analyis of variance and simple regression analysis were carried out for yield and yield components studied following statistical procedure appropriate for the experimental design. Whenever, treatment effects were found significant, the means were separated using Duncan's Multiple Range Test using SAS statistical package (SAS Institute, 1999).

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## Results and Discussion

### Soils and Soil Potassium Status

In 2005/06 and 2006/07 cropping seasons, the experiments were conducted on five and six location, respectively located in Yilmana Densa, Banja and Farta woredas. According to Yihenew (2002), the soils in the research areas are Nitosols, Acrisols and Luvisols. The results of soil analysis indicated that Nitosols of Yilmana Densa had better K status followed by Luvisols of Farta . Acrisols of Banja had the lowest values (Table 1).

Based on the soil analysis results of soils samples collected from six experimental sites in Yilmana Densa, Banja and Farta woredas in 2006/07 cropping season also indicated that Nitosols of Yilmana Densa Woreda contained relatively higher amount of exchangeable K followed by Luvisols of Farta Woreda and Acrisols of Banja Woreda.

Table 1. Exchangeable K status of different soils covered by the experiment in 2005/06 and 2006/2007 cropping seasons

| Year | Location | Woreda | Soil Type | Exchangeable K ($cmol_c\ kg^{-1}$) |
|---|---|---|---|---|
| 2005/2006 | Mossobo | Yilmana Densa | Nitosol | 0.81 |
| | Adet Hanna | Yilmana Densa | Nitosol | 0.71 |
| | Wonjella | Banja | Acrisol | 0.10 |
| | Debre tabor | Farta | Luvisol | 0.31 |
| | Tsegur | Farta | Luvisol | 0.41 |
| 2006/2007 | Mossobo | Yilmana Densa | Nitosol | 1.41 |
| | Debre Mewi | Yilmana Densa | Nitosol | 1.32 |
| | Biden Jebella | Banja | Acrisol | 0.18 |
| | Injibara | Banja | Acrisol | 0.22 |

The two years results indicated that, based on Beerneart (1990), K status is high and very high in Nitosols of Yilmana Densa, medium in Luvisols of Farta and low in Acrisols of Banja.

**Potato Tuber Number**

Potassium fertilizer rate did not have a significant effect on potato tuber number at four of the five locations in 2005/2006. A significant difference in potato tuber number per plant due to K fertilizer application was achieved only on Acrisols of Wonjella in Banja Woreda (Table 2). However, the significant increase was achieved up to application of 30 kg ha$^{-1}$ $K_2O$. Increasing the rate beyond this rate did not bring a significant effect on the parameter considered.

Table 2. The Effect of K Fertilizer Rates on Potato Tuber number in 2005/06 cropping season (number/3.6m$^2$)

| Year | Treatments | Location | | | | |
|---|---|---|---|---|---|---|
| | | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| | 0 kg ha$^{-1}$ | 166.7a | 135.0a | 33.7b | 126.0a | 94.7a |
| | 30 kg ha$^{-1}$ | 141.0a | 130.0a | 57.0a | 133.3a | 122.0a |
| | 60 kg ha$^{-1}$ | 195.0a | 101.7a | 55.3a | 94.7a | 94.7a |
| | 90 kg ha$^{-1}$ | 171.7a | 124.3a | 34.0b | 112.3a | 103.0a |
| | 150 kg ha$^{-1}$ | 187.3a | 112.7a | 39.3b | 109.7a | 146.0a |
| | 210 kg ha$^{-1}$ | 149.0a | 115.0a | 32.7b | 107.7a | 136.7a |
| | CV (%) | 17.6 | 20.3 | 15.9 | 28.3 | 31.4 |
| | *P(0.05)* | ns | ns | * | ns | Ns |

* = significant; ns= not significant

However, results of the experiment conducted in 2006/07 cropping season indicated that application of K fertilizer also did not give a significant effect on number of tubers produced per plant across all locations (Table 3). It is worthy enough to note

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that locations incorporated in the experiment in this year in each Woreda had relatively higher exchangeable K levels as compared to sites included in each Woreda in the previous year which generally diminished the effect of K fertilizer on this paramenter.

This suggests that this yield component did not play a significant role in determining the tuber yield of potato.

Table 3. The Effect of K Fertilizer Rate on tuber number in 2006/07 cropping season (number per 3.6 $m^2$)

| Treatments | Location | | | | | |
|---|---|---|---|---|---|---|
| | Mossobo Nitosol | Debre Mewi Nitosol | Biden Jebella Acrisol | Injibara Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg $ha^{-1}$ | 76.3 a | 76.3 a | 89.0 a | 94.0 a | 104.0 a | 71.7a |
| 30 kg $ha^{-1}$ | 79.3 a | 76.3 a | 85.0 a | 117.0 a | 93.7 a | 71.0 a |
| 60 kg $ha^{-1}$ | 57.0 a | 62.0 a | 76.7 a | 108.7 a | 116.3 a | 89.0 a |
| 90 kg $ha^{-1}$ | 78.3 a | 59.0 a | 90.7 a | 113.7 a | 112.3 a | 93.3 a |
| 150 kg $ha^{-1}$ | 64.0 a | 75.3 a | 99.7 a | 105.3 a | 86.3 a | 101.0 a |
| 210 kg $ha^{-1}$ | 57.3 a | 55.7 a | 88.3 a | 115.0 a | 93.0 a | 79.7 a |
| CV (%) | 21.2 | 30.2 | 14.0 | 11.9 | 31.0 | 23.4 |
| *P(0.05)* | ns | ns | ns | ns | ns | ns |

ns= not significant

**Plant Height**

Except at one location (Mossobo Nitosols), K fertilizer rate did not have a significant effect on plant height of potato (Table 4). It is also necessary to note that the data on plant height obtained from this specific location did not have defined trend to make firm conclusion.

Table 4. The Effect of K Fertilizer Rates on plant height of potato plant in 2005/06 cropping season (cm)

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg $ha^{-1}$ | 38.0b | 37.2a | 28.3a | 33.7a | 28.7a |
| 30 kg $ha^{-1}$ | 40.3ab | 32.4a | 27.7a | 36.6a | 30.6a |
| 60 kg $ha^{-1}$ | 39.7ab | 36.5a | 28.3a | 34.6a | 32.6a |
| 90 kg $ha^{-1}$ | 42.1a | 36.7a | 30.0a | 34.7a | 33.0a |
| 150 kg $ha^{-1}$ | 41.6a | 35.6a | 28.4a | 35.1a | 32.8a |

| | | | | | |
|---|---|---|---|---|---|
| 210 kg ha$^{-1}$ | 40.5ab | 32.5 | 30.1a | 36.3a | 31.3a |
| CV(%) | 4.4 | 8.1 | 5.3 | 6.7 | 15.2a |
| *P*(0.05) | * | ns | ns | ns | Ns |

* = significant; ns= not significant

The result obtained in 2006/07 cropping season also indicated that potassium fertilizer did not give a significant effect on plant height of potato plants on four of the five testing sites included in the experiment (Table 5).

It is, therefore, possible to suggest that potassium nutrient may not have a significant contribution in increasing the height of potato plants.

Table 5. The Effect of K Fertilizer Rate on plant height of potato in 2006/07 cropping season (cm)

| Treatments | Location | | | | | |
|---|---|---|---|---|---|---|
| | Mossobo Nitosol | Debre Mewi Nitosol | Biden Jebella Acrisol | Injibara Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg ha$^{-1}$ | 49.2 a | 46.6 a | 46.6 a | 20.3 b | 49.6 a | 49.1 a |
| 30 kg ha$^{-1}$ | 51.2 a | 47.2 a | 44.3 a | 23.0 ab | 52.2 a | 48.6 a |
| 60 kg ha$^{-1}$ | 49.3 a | 44.5 a | 44.9 a | 24.1 ab | 54.3 a | 52.8 a |
| 90 kg ha$^{-1}$ | 51.8 a | 43.8 a | 45.7 a | 25.9 ab | 56.1 a | 53.2 a |
| 150 kg ha$^{-1}$ | 45.6 a | 43.3 a | 44.9 a | 25.5 ab | 52.6 a | 52.3 a |
| 210 kg ha$^{-1}$ | 50.0 a | 44.7 a | 46.9 a | 26.9 a | 55.8 a | 49.7 a |
| CV (%) | 8.9 | 5.4 | 11.8 | 12.1 | 6.4 | 7.6 |
| *P(0.05)* | ns | ns | ns | * | ns | ns |

* = significant; ns= not significant

## Number of Main Stems per Plant

Application of different rates of K fertilizer did not affect the number of main stems per plant of potato at all of the locations included in 2005/06 cropping season (Table 6).

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Table 6. The Effect of K Fertilizer Rates on number of main stems per plant of potato in 2005/06 cropping season (number/plant)

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg ha$^{-1}$ | 5.0a | 4.7a | 3.0a | 4.0a | 6.3a |
| 30 kg ha$^{-1}$ | 3.7a | 4.7a | 3.7a | 3.7a | 5.7a |
| 60 kg ha$^{-1}$ | 5.0a | 5.0a | 3.0a | 4.3a | 5.7a |
| 90 kg ha$^{-1}$ | 4.3a | 5.3a | 3.3a | 3.7a | 5.3a |
| 150 kg ha$^{-1}$ | 4.7a | 5.3a | 3.0a | 4.3a | 6.0a |
| 210 kg ha$^{-1}$ | 4.3a | 5.0a | 3.0a | 3.7a | 6.3a |
| CV (%) | 28.7 | 19.7 | 14.1 | 12.8 | 12.7 |
| *P(0.05)* | ns | ns | ns | ns | ns |

ns= not significant

Similar trend was observed in 2006/07 cropping season as that of the previous year. Significant effect was observed only at Acrisol of Injibara on-station. On the rest of the locations, K fertilizer application did not significantly affect the number of stems per plant (Table 7). The two years results suggest that this yield component did not significantly contribute to the difference obtained in potato tuber yield.

Table 7. The Effect of K Fertilizer Rate on number of stems per plant in 2006/07 cropping season (number/plant)

| Treatments | Location | | | | | |
|---|---|---|---|---|---|---|
| | Mossobo Nitosols | Debre Mewi Nitosols | Biden Jebella Acrisol | Injibara Acrisol | Debre Tabor Luvisol | Tsegur Luvisols |
| 0 kg ha$^{-1}$ | 5.7 a | 5.7 a | 3.3 a | 2.7 b | 4.3 a | 4.3 a |
| 30 kg ha$^{-1}$ | 6.7 a | 6.0 a | 3.3 a | 3.3 ab | 6.0 a | 4.0 a |
| 60 kg ha$^{-1}$ | 5.7 a | 5.7 a | 3.0 a | 3.3 ab | 5.0 a | 4.3 a |
| 90 kg ha$^{-1}$ | 6.0 a | 6.0 a | 3.3 a | 3.7 ab | 5.3a | 4.7 a |
| 150 kg ha$^{-1}$ | 4.7 a | 5.7 a | 3.3a | 3.7 ab | 5.3 a | 5.3 a |
| 210 kg ha$^{-1}$ | 6.0 a | 6.3 a | 2.7 a | 4.0 a | 5.7a | 3.7 a |
| CV (%) | 18.3 | 10.6 | 17.3 | 14.7 | 17.5 | 22.3 |
| *P(0.05)* | ns | ns | ns | * | ns | ns |

* = significant; ns= not significant

**Mean Tuber Weight**

Application of K fertilizer gave a significant effect on mean tuber weight of potato at 3 locations (Adet Hanna Nitosol, Wonjella Acrisol and Tsegur Luvisol) out of the five locations incorporated in the experiment in 2005/06 cropping season (Table 8).

Table 8. The Effect of K Fertilizer Rate on mean tuber weight of potato in 2005/06 cropping season (gm/tuber)

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg $ha^{-1}$ | 59.1 a | 70.5 ab | 19.3 b | 35.4 a | 63.2 ab |
| 30 kg $ha^{-1}$ | 61.5 a | 61.1 b | 24.1 ab | 35.6 a | 53.6 ab |
| 60 kg $ha^{-1}$ | 50.4 a | 82.5 a | 24.8 ab | 44.0 a | 75.3 a |
| 90 kg $ha^{-1}$ | 56.3 a | 65.6 ab | 30.1 ab | 45.4 a | 68.2 ab |
| 150 kg $ha^{-1}$ | 47.4 a | 70.3 ab | 24.3 ab | 46.1 a | 52.3 b |
| 210 kg $ha^{-1}$ | 60.5 a | 68.8 b | 33.1 a | 46.9 a | 55.0 b |
| CV (%) | 12.9 | 13.5 | 22.0 | 18.9 | 17.1 |
| *P(0.05)* | ns | * | * | ns | * |

* = significant; ns= not significant

However, in 2006/07 cropping season only two locations in Banja woreda which have Acrisol soil type gave significant difference in mean potato tuber weight (Table 9). From the results of the experiments of the two years it is possible to conclude that this yield component affected tuber yield of potato on Acrisol of Banja Woreda. Therefore, in both years, significant effect on mean tuber yield was obtained on Acrisols of Banja Woreda.

Table 9. The Effect of K Fertilizer Rate on mean tuber weight of potato in 2006/07 cropping season (gm/tuber)

| Treatments | Location | | | | | |
|---|---|---|---|---|---|---|
| | Mossobo Nitosol | Debre Mewi Nitosol | Biden Jebella Acrisol | Injibara Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg $ha^{-1}$ | 88.7 a | 63.3 a | 29.5 b | 29.6 c | 61.J a | 53.9 a |
| 30 kg $ha^{-1}$ | 87.3 a | 61.7 a | 45.9 a | 32.4 cb | 76.3 a | 47.7 a |
| 60 kg $ha^{-1}$ | 95.5 a | 70.7 a | 43.6 ab | 36.1 ab | 59.0 a | 58.2 a |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 90 kg ha$^{-1}$ | 97.5 a | 69.4 a | 45.1 a | 41.0 a | 59.3 a | 55.5 a |
| 150 kg ha$^{-1}$ | 83.4 a | 65.5 a | 48.2 a | 40.3 a | 71.2 a | 50.1 a |
| 210 kg ha$^{-1}$ | 93.7 a | 65.9 a | 46.5 a | 42.0 a | 68.3 a | 54.8 a |
| CV (%) | 8.4 | 10.3 | 19.4 | 9.1 | 23.9 | 22.6 |
| *P(0.05)* | ns | ns | * | * | ns | ns |

* = significant; ns= not significant

**Percent Tuber Dry Matter Yield**

Application of different rates of K fertilizer did not affect the % tuber dry matter yield at four of the five locations. At Adet Hanna Nitosol, where significant difference was achieved, the data seem inconsistent and lack clear trend to make a conclusion (Table 10). Therefore, it is possible to suggest that K nutrient does not contribute a lot in determining potato dry matter yield.

Table 10. The Effect of K Fertilizer Rates on % tuber dry matter yield of potato in 2005/06 cropping season

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg ha$^{-1}$ | 17.1a | 22.5ab | 22.4a | 24.6a | 24.1a |
| 30 kg ha$^{-1}$ | 16.6a | 22.9ab | 18.7a | 23.4a | 23.2a |
| 60 kg ha$^{-1}$ | 18.2a | 21.9b | 21.5a | 23.6a | 23.8a |
| 90 kg ha$^{-1}$ | 18.2a | 24.7a | 19.4a | 24.3a | 23.0a |
| 150 kg ha$^{-1}$ | 18.2a | 22.8a | 21.6a | 25.2a | 23.1a |
| 210 kg ha$^{-1}$ | 17.6a | 22.0ab | 20.2a | 23.4a | 23.5a |
| CV (%) | 10.2 | 5.0 | 10.7 | 4.7 | 2.6 |
| *P(0.05)* | ns | ns | ns | ns | ns |

ns= not significant

**Potato Tuber Slices Shelving Life**

Application of K fertilizer improved shelving quality of sliced potato tubers by hindering oxidation of starch and darkening of the tuber surface at four of the five locations (Table 11). Nitosols of Mossobo and Adet Hana, which had relatively higher soil K level, exhibited no response for K application in terms of shelving quality of sliced potato tubers shelved for 48 hours after being sliced.

Table 11. The effect of K fertilizer rates on darkening of potato tuber tissue surface due to oxidation of starch in 2006/07 cropping season (%)

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg ha$^{-1}$ | 54.7a | 64.4a | 74.2c | 81.3ab | 89.4c |
| 30 kg ha$^{-1}$ | 48.3a | 58.3a | 59.4cb | 86.1b | 75.8b |
| 60 kg ha$^{-1}$ | 56.7a | 63.9a | 41.1ab | 73.5ab | 64.5ab |
| 90 kg ha$^{-1}$ | 43.5a | 60.6a | 40.9ab | 76.7ab | 60.0a |
| 150 kg ha$^{-1}$ | 45.0a | 62.0a | 32.2a | 67.6a | 68.3ab |
| 210 kg ha$^{-1}$ | 37.5a | 52.5a | 38.0ab | 70.0ab | 66.9ab |
| CV(%) | 25.6 | 23.3 | 26.4 | 10.9 | 9.5 |
| *P(0.05)* | ns | ns | * | * | * |

* = significant; ns= not significant

**Potato Tuber Yield**

Results of the experiment indicated that K fertilizer rate does not have a significant effect on potato tuber yield on Nitosols of Yilmana Densa and Luvisols of Farta Woredas. A significant difference was attained only on Acrisols of Wonjella in Banja Woreda (Table 12). However, a significant yield increase was obtained up to application of 30 kg ha$^{-1}$. Beyond this rate significant yield increase was not observed.

Table 12. The effect of K fertilizer rate on tuber yield of potato in 2005/06 cropping season (Kg ha$^{-1}$)

| Treatments | Location | | | | |
|---|---|---|---|---|---|
| | Mossobo Nitosol | Adet Hanna Nitosol | Wonjella Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg ha$^{-1}$ | 21259a | 19407a | 1805.6b | 11019.0 a | 16287a |
| 30 kg ha$^{-1}$ | 19259a | 17185a | 3101.9a | 12685.0 a | 17852a |
| 60 kg ha$^{-1}$ | 21704a | 18222a | 3796.3a | 11481.0a | 18167a |
| 90 kg ha$^{-1}$ | 21037a | 18000a | 2850.6ab | 13882.0a | 18713a |
| 150 kg ha$^{-1}$ | 19630a | 17481a | 2731.5ab | 13981.0a | 20944a |
| 210 kg ha$^{-1}$ | 20000a | 17630a | 2618.5ab | 13982.0a | 20213a |
| CV (%) | 9.2 | 17.9 | 29.9 | 13.9 | 22.4 |
| *P(0.05)* | ns | ns | * | ns | ns |

* = significant; ns= not significant

It is important to note that the yield from Wonjella location was very low as compared to other locations which indicated overall deficiency of major nutrients and deteriorated soil physical condition. In such cases, increasing K rate alone cannot bring yield increase unless the demand for other yield limiting nutrients is met.

Results of the experiment conducted in 2006/07 cropping season also indicated that potato planted on Acrisols of Banja Woreda responded for K application. Similar to the previous year, potato planted on Nitosols of Yilmana Densa and Luvisols of Farta (one location) did not respond to K application (Table 13).

Table 13. The Effect of K Fertilizer Rate on Tuber Yield of Potato in 2006/07 cropping season (Kg $ha^{-1}$)

| Treatments | Location | | | | | |
|---|---|---|---|---|---|---|
| | Mossobo Nitosol | Debre Mewi Nitosol | Biden Jebella Nitosol | Injibara Acrisol | Debre Tabor Luvisol | Tsegur Luvisol |
| 0 kg $ha^{-1}$ | 18519.0 a | 13334.0 a | 72963.0 c | 7750.0 b | 17639.0 a | 8704.0 b |
| 30 kg $ha^{-1}$ | 19074.0 a | 13148.0 a | 8213.0 bc | 10481.0 ab | 18009.0 a | 11065.0 ab |
| 60 kg $ha^{-1}$ | 15185.0 a | 11944.0 a | 9305.6 b | 10926.0 ab | 18287.0 a | 14352.0 a |
| 90 kg $ha^{-1}$ | 21296.0 a | 11667.0 a | 11287.0 a | 12889.0 a | 18287.0 a | 14213.0 a |
| 150 kg $ha^{-1}$ | 18667.0 a | 13426.0 a | 12250.0 a | 11824.0 a | 16065.0 a | 14120.0 a |
| 210 kg $ha^{-1}$ | 14815.0 a | 10000.0 a | 12064.8 a | 13222.0 a | 17593.0 a | 12130.0 ab |
| CV (%) | 20.2 | 28.7 | 9.1 | 14.3 | 21.3 | 18.8 |
| *P(0.05)* | ns | ns | * | * | ns | * |

* = significant; ns= not significant

## Conclusions and recommendations

From the results of the experiment, it is possible to conclude that increasing K fertilizer rate did not significantly increase potato tuber number, plant height, number of main stems per plant and potato dry matter yield on Nitosols, Acrisols and Luvisols. However, increase in K fertilizer rate significantly increased mean tuber weight, and tuber yield of potato on Acrisols. Increase in K fertilizer rate also significantly improved shelving life of potato. Moreover, potato tuber yield had linear and positive relationship with soil exchangeable K status even though potato tuber yield response to K fertilizer application had negative relationship with soil K status. From the results of the experiment, it is possible to recommend that application of 30kg $ha^{-1}$ on Acriosls of Banja Woreda could be taken as blanket fertilizer recommendation. For those soils with exchangeable K values of greater than 0.3 $cmol_c\ kg^{-1}$, it is less likely that response for K fertilizer may be obtained. Therefore, it is advisable to make soil analysis prior to determine whether to apply K fertilizer or not. But still, further investigation is required to reach to firm recommendation.

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