Response of Cotton to Potassium Levels Under Water Regime

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Abstract: A field trial was conducted at Experimental Field of Field Crop Department of College of Agriculture-Abu-Graib during 2011 and 2012 seasons to investigate the effect of potassium level in growth, lint yield and its components of cotton (Gossypium hirsutum L.) cultivar Lashata was grown under abundance and deficit water conditions. Split plot arrangement with randomized complete block design was used with three replicates. Irrigation intervals occupied main plots (Irrigation weekly and each two weeks) while potassium levels (0, 220, 280, 340, 400 kg K₂O/ha) occupied subplots. The statistical analysis showed superiority of irrigation at two weeks of seed cotton yield (3.75 t/h), number of open bolls per plant (20.47), number of sympodium per plant (19.65 and 17.27), ginning percentage (37.47) and water use efficiency (0.38 kg/m³). There were significant effect of potassium in traits. The level 340 kg K₂O/ha was gave the highest seed cotton yield (3.87 t/ha) due to attained the highest number of open bolls (29.25 bolls per plant for first season and gave 3.71 t/ha at 280 kg K₂O/ha due to higher boll weight (3.57 g) for second season. It could be conclude irrigation at two weeks with apply 280 kg K₂O/ha hadk attained the highest seed cotton and ginning percentage to reduce water requirements of cotton in central region of Iraq.

Keywords: Irrigation Intervals, K, Seed Cotton Yield, WUE

1. Introduction

Generally the world agricultural production affected by environmental stresses which restricts the productivity of plant production to 50% of its potential [1]. Just 10% from total world agricultural area that not faced stresses factors. Drought stress effecting growing and productivity is one of the most widespread environmental stresses exposed to the usable areas of the Earth up to 26% when classified in view of stress factors [2]. Due to drought condition simulate most physiological, biochemical and molecular responses, therefore plant developed its mechanisms to adapt to limited environment inputs, also drought consider the major factor for world geographical plant distribution and contribute of field crop development [3, 4]. Usually drought associated with raising temperature and radiation, therefore drought consider the most important environmental stresses, it is restricted survival, distribution and productivity of field crops, caused higher economic losses. Genetic potential change according to environmental factors such as water, fertilizer, temperature, day length (photoperiod) and solar radiation [5]. Cotton is the summer crop therefore can be improve its yield by use suitable management such as increase water use efficiency, but the limitation of water resources effect in growth and yield of world cotton.

The optimum levels of nutrients have play vital role in growth and yield of cotton under water deficit conditions especially in arid and semi-arid condition, however requirements of fertilizer become higher under irrigation compare with rainfall conditions. Potassium play important role in osmotic mechanisms and stomata conductance that important for plant water relationships and cell expansion [6]. Potassium one of the essential and important positive ion cytoplasm composition of higher plants, however its concentration reach to 80-150 Mm [7], root uptake it from soil by active absorption [8], and moving to plant tissues. Although potassium have not construction in any part of plant but it has integrally involved in metabolism process.
water plant relationships and it has essential role in activation of many enzymes, has contribution in reaction for more than 60 enzymes [9] contribute in many biological processes in plant such as photosynthesis, respiration, carbohydrate synthesis, translocation and synthesis of proteins. The most important function of potassium which maintains of osmotic potential and water absorption. Both functions are clear through regulation of stomata conductance [10, 11].

Potassium had did impact plant height, number of squares and bolls number for two plant such as photosynthesis, respiration, carbohydrate potassium (0, 220, 280, 340 and 400 kg K$_2$O/ha) caused decreased of plant height, bolls number and seed cotton yield with increase water stress, but percentage of first boll and ginning percentage were increased. Also potassium levels were affected significantly in plant height, bolls number, seed cotton yield, boll weight and ginning percentage. Xia et al [16] obtained significant differences in physiological and morphological traits such as plant height, number of squares and bolls number for two genotypes of cotton under water stress. Abood et al., [17] found about 100% of available water was gave highest yield but not differed from 80% level. Potassium had did impact significantly, the level 240 kg/ha gave the highest yield but not differed from 480 kg/ha. The present study aimed to investigate of different potassium levels under two water intervals (weekly and at two weeks) in growth and seed cotton yield of cotton under the central region conditions of Iraq.

2. Material and Methods

A field trial was conducted at Experimental Field of Field Crops Department-College of Agriculture-Abu-Graib during 2011 and 2012. All field practices were done according to standard recommendations [18]. Seed of Lashata cultivar was sown at 4 and 8 April for 2011 and 2012 respectively. Split plot arrangement by randomized complete block design with three replicates was used, Irrigation intervals (weekly and at two weeks) occupied main plots while potassium levels of plant height in both seasons.

The highest value of plant height (175 and 165 cm) were obtained in plant height. This result agree with founds of other researchers such as Riahinia [21], Al-Khirllah [22], Yagmur et al., [15] and Abood et al., [17]. Associated potassium levels significant increment of plant height, it had increment from 113 to 156 cm with increment percentage about 28% in first season when increased potassium level from no potassium to 400 kg K$_2$O/ha, and 104.5 to 156.33 cm with increment percentage about 33% when increased potassium level from no potassium to 340 kg K$_2$O/ha at second season. Potassium one of importance common cation and commonly associated with many plant physiological processes such as photosynthesis, proteins synthesis, enzyme activity and water relationships of plant, it could be effect in growth development and delayed of leaf senescence [6], and then increasing plant height. Also potassium has play important role in cell division expansion and improve of plant hormones action which could be contribute directly in plant growth and reflect positively in plant height increasing [23]. Generally can be show that increasing potassium level had caused increasing plant height but there is an optimum level for potassium beyond it plant height became decreasing. Result were simulation with other result such as Abood et al., [17] and Yagmur et al., [15] they had pointed to superiority of potassium application compare with not application.

Significant interaction was obtained between irrigation intervals and potassium levels of plant height in both seasons. The highest value of plant height (175 and 165 cm) were obtained at weekly irrigation and 400 kg K$_2$O/ha, while less value (101 and 98.7 cm) when irrigated at two week and zero
potassium at first and second season respectively. Generally can be show increment of potassium levels was associated with positive response of plant height for each irrigation interval. Potassium increased of apical meristems ability to attain increasing plant growth especially at water scarcity condition. However that refer to importance of this vital nutrient in increasing plant growth and development which affected by water availability.

### 3.2. Number of Monopodium

Irrigation intervals was not effected in number of monopodium at both seasons (Table 2). While had associated increasing potassium levels significant decrement of number monopodium per plant, it was decreased from 3.83 to 2.25 when increased potassium levels from zero to 280 kg/ha with 7% decreasing percentage at first season, while at second season 340 kg/ha gave less monopodium number (2.67) with 62% decreasing percentage compare with no potassium.

| Year  | K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean   | Irrigation weekly | Irrigation at tow weeks | Mean   |
|-------|-------------|-------------------|------------------------|--------|-------------------|------------------------|--------|
| 2010  |             |                   |                        |        |                   |                        |        |
|       | 0           | 125.00            | 101.00                 | 113.00 | 110.33            | 98.67                  | 104.50 |
|       | 220         | 132.33            | 126.00                 | 129.17 | 134.67            | 119.00                 | 128.63 |
|       | 280         | 167.67            | 129.00                 | 148.33 | 152.67            | 128.67                 | 140.67 |
|       | 340         | 169.67            | 137.00                 | 153.33 | 165.33            | 147.33                 | 156.33 |
|       | 400         | 175.00            | 137.00                 | 156.00 | 163.67            | 140.07                 | 152.17 |
|       | l. s. d 5%  | 3.81              | 2.14                   | 5.73   |                   |                        | 2.37   |
| Mean  |             | 153.93            | 126.00                 | 145.33 | 126.87            |                        |        |
| l. s. d 5% | 4.72            |                   | 7.54                   |        |                   |                        |        |

### 3.3. Number of Sympodium

Irrigation intervals and potassium levels were affected significantly of number of sympodium per plant (Table 3). Number of sympodium increased significantly at two week interval irrigation it gave 19.65 and 17.27 number of sympodium per plant compare with weekly irrigation that gave 15.35 and 14.4 number of sympodium per plant with 22 and 17% increasing percentage for first and second season respectively. Sympodium initiation and development consider one of the important criteria in cotton productivity, it was associated with increasing them which express of productivity plant potential to initiation and develop of squares those development at advance stages to open bolls. This result simulated with results of other researchers such as Soomro et al., [24], Oad et al., [25] and Al-Khirllah [22] but not agree with Abood et al., [17]. Number of sympodium increased with increasing potassium levels. It increased from 14.02 to 20.77 number of sympodium per plant with 32% increasing percentage at first season when increasing from no potassium to 280 and f 12 to 18.5 sympodium per plant with increasing percentage 35% when increasing from no potassium to 340 kg K₂O/ha at second season. Potassium had contribution vital play in the most metabolic processes of plant such as carbon synthesis, Protein synthesis, enzymes activities and assimilates translocation of plant parts especially fruiting parts. Can be show that rapid increment of sympodium production with increasing potassium levels to critical level, beyond any excessive applied effect negatively and inhibition some plant metabolism. This result agree with found of Abood et al., [17].

Significant interaction was obtained between irrigation intervals and potassium levels of number of sympodium per
plant, the highest number (24.77) had obtained at two weeks irrigation and 280 kg K₂O₂/ha at first season and 20.67 under two weeks irrigation with 340 kg K₂O₂/ha at second season. That role due to positive response of potassium in somatic adjustment and regulation of water potential in plant through stomata conductance. Therefore potassium application consider one of easy and important strategically ways to face problems of water deficit and scarcity.

### Table 3. Effect of irrigation intervals and potassium levels in number of sympodium per plant.

|     | 2010 |             |             | 2011 |             |             |
|-----|------|-------------|-------------|------|-------------|-------------|
|     | K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean | Irrigation weekly | Irrigation at tow weeks | Mean |
| 0   | 12.93 | 15.10       | 14.02       | 12.33 | 11.67       | 12.00       |
| 220 | 14.77 | 18.77       | 16.77       | 14.67 | 15.00       | 14.83       |
| 280 | 15.77 | 24.77       | 20.77       | 13.33 | 20.33       | 16.83       |
| 340 | 17.60 | 20.77       | 19.18       | 16.33 | 20.67       | 18.50       |
| 400 | 15.67 | 18.83       | 17.25       | 15.33 | 18.67       | 17.00       |
| l. s. d 5% | 1.98 |             | 1.42       | 1.87  |             | 1.46        |
| Mean | 15.35 | 19.65       |             | 14.4  | 17.27       |             |
| l. s. d 5% | 1.74 |             |             | 0.76  |             |             |

### 3.4. Number of Total Bolls Per Plant

Statistical analysis refer to not effect of irrigation intervals in number of total bolls in both seasons (Table 4). While increasing potassium levels had associated with significantly increasing in both seasons, which increased from 28.83 to 36.17 bolls with increasing percentage about 20% when increasing potassium levels from zero to 280 kg K₂O₂/ha but did not differ significantly from 280 and 400 kg K₂O₂/ha at second season.

### Table 4. Effect of irrigation intervals and potassium levels in number of total bolls per plant.

|     | 2010 |             |             | 2011 |             |             |
|-----|------|-------------|-------------|------|-------------|-------------|
|     | K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean | Irrigation weekly | Irrigation at tow weeks | Mean |
| 0   | 29.33 | 28.33       | 28.83       | 17.33 | 17.67       | 17.50       |
| 220 | 27.67 | 27.67       | 27.67       | 22.67 | 22.67       | 22.67       |
| 280 | 32.00 | 40.33       | 36.17       | 26.67 | 26.33       | 23.50       |
| 340 | 27.00 | 31.33       | 29.17       | 25.33 | 25.87       | 25.50       |
| 400 | 27.00 | 25.33       | 26.17       | 23.00 | 24.00       | 23.50       |
| l. s. d 5% | 3.11 |             | 1.93       | n. s  |             | 2.70        |
| Mean | 28.6  | 30.6        |             | 23.00 |             |             |
| l. s. d 5% | n. s |             |             | 23.27 |             |             |

That may be due to the important role of potassium in the most biological metabolism, proteins synthesis and increasing enzymes activities they related with growth and developmental reproductive stages from initiation of buds, flowering, fertilization, growth and development of boll. Can be show that an optimum potassium level had attained optimum bolls number beyond it decreased. Significant interaction was obtained between irrigation intervals and potassium levels at first season. The highest bolls number (40.33 bolls) was obtained at two week irrigation interval and 280 kg/ha of potassium, while less number (25.33 boll per plant) had attained under same irrigation interval and 400 kg K₂O₂/ha.

### 3.5. Number of Open Bolls Per Plant

Irrigation intervals were effected significantly at second season while potassium levels effected significantly at both seasons in number of open bolls per plant (Table 5). The highest number was reached at two week irrigation interval, while decreased at weekly irrigation from 20.47 to 18.8 open bolls at second season. Decreasing number of open boll had caused by decreasing total boll number (Table 4). Can be explained increasing open boll under deficit irrigation to attain optimum growth and little shedding. This result was simulated with results of other researchers such as Soomro et al., [24], Onder et al., [26] and Al-Khirllah [22], they found cotton plant had higher ability to adapt under water stresses conditions, while didn’t agree with Elian [27] and Alishah and Ahmedkhan [28] they found number of bolls produced under stresses condition less compare with an optimum conditions.

### Table 5. Effect of irrigation intervals and potassium levels of cotton in number of open bolls per plant.

|     | 2010 |             |             | 2011 |             |             |
|-----|------|-------------|-------------|------|-------------|-------------|
|     | K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean | Irrigation weekly | Irrigation at tow weeks | Mean |
| 0   | 22.67 | 22.52       | 22.59       | 13.33 | 16.33       | 14.83       |
| 220 | 22.93 | 25.33       | 24.13       | 17.33 | 19.00       | 18.17       |
| 280 | 24.83 | 33.67       | 29.25       | 23.33 | 25.33       | 24.33       |
| 340 | 23.43 | 26.67       | 25.05       | 21.67 | 23.33       | 22.50       |
| 400 | 22.60 | 16.93       | 19.77       | 18.33 | 18.33       | 18.33       |
| l. s. d 5% | 2.61 |             | 1.53       | n. s  |             | 2.06        |
| Mean | 23.29 | 25.02       |             | 18.8  |             | 20.47       |
| l. s. d 5% | n. s |             |             | 0.76  |             |             |
Potassium levels were effected significantly in number of open bolls, it increased from 22.59 to 29.25 open bolls per plant with 23% increasing percentage at first season also increased from 14.83 to 24.33 open bolls with 39% increasing percentage when increased potassium level from zero to 280 kg K₂O/ha at second season. Can be show obtained gradually decreament in open bolls with increased potassium level from optimum level. Increasing open bolls with increasing potassium level because its impact in most biological and metabolic processes of plant, it was effected in plant with 23% increasing percentage at first season also potassium level.

Potassium in first season also same level gave the highest \( K \) (33.67) at two week interval with 280 kg K₂O/ha obtained between irrigation intervals and potassium level in number of open bolls at first season. The highest value obtained gradually decrement in open bolls with increased potassium level because its impact in most reproductive growth, while at two weeks interval was happened inverse. Therefore increase irrigation interval

### 3.6. Boll Weight

Irrigation intervals and potassium level were effected significantly in boll weight (Table 6). Weekly interval irrigation was gave the highest value about 4.00 and 3.56 g while two weeks interval gave less value about 3.49 and 3.41 g with increasing percentage 13 and 4% for first and second seasons respectively. Decreasing boll weight under water stress belong to deficit of assimilates especially during reproductive stage which led to decreasing boll weight and increasing total bolls and open bolls number per plant (Table 4 and 5) associated decreament boll weight as a compensation relationship. Some other researchers found similar results such as Mahmood [29], Ondero et al., [26] and Al-Khirllah [22], while Mutar [30] referred irrigation at two weeks interval was appeared superior performance compare with other treatment in this trait.

| K₂O (kg/ha) | 2010 | 2011 |
|-------------|------|------|
|             | Irrigation weekly | Irrigation at two weeks | Mean | Irrigation weekly | Irrigation at two weeks | Mean |
| 0           | 3.13 | 3.08 | 3.11 | 3.20 | 2.97 | 3.08 |
| 220         | 3.67 | 3.10 | 3.39 | 3.93 | 3.23 | 3.58 |
| 280         | 3.43 | 3.20 | 3.32 | 3.67 | 3.47 | 3.57 |
| 340         | 4.57 | 4.16 | 4.37 | 3.67 | 3.73 | 3.70 |
| 400         | 3.68 | 3.89 | 3.79 | 3.31 | 3.63 | 3.47 |
| l. s. d 5%  | 0.17 | 0.13 | 0.30 | 0.23 |      |      |
| Mean        | 4.00 | 3.49 | 3.56 | 3.41 |      |      |
| l. s. d 5%  | 0.02 |      | 0.13 |      |      |      |

### 3.7. Seed Cotton Yield

Seed cotton yield was affected significantly by irrigation intervals at first season and potassium levels for both seasons (Table 7). Seed cotton yield was increased from 3.31 to 3.75 t/ha at two weeks irrigation interval with 12% increasing percentage. Seed cotton yield was increased due to increased sympodium number (Table 3), total bolls number (Table 4) and number of open bolls (Table 5).

| K₂O (kg/ha) | 2010 | 2011 |
|-------------|------|------|
|             | Irrigation weekly | Irrigation at two weeks | Mean | Irrigation weekly | Irrigation at two weeks | Mean |
| 0           | 2.92 | 3.08 | 2.97 | 2.17 | 1.99 | 2.08 |
| 220         | 3.41 | 3.48 | 3.45 | 2.63 | 2.51 | 2.57 |
| 280         | 3.68 | 3.59 | 3.64 | 3.61 | 3.80 | 3.71 |
| 340         | 3.34 | 4.39 | 3.87 | 3.25 | 3.29 | 3.27 |
| 400         | 3.22 | 4.21 | 3.72 | 2.72 | 3.11 | 2.92 |
| l. s. d 5%  | 0.21 |      | 0.16 | 0.18 |      | 0.11 |
| Mean        | 3.31 | 3.75 |      | 2.88 |      | 2.94 |
| l. s. d 5%  | 0.12 |      |      | n. s |      |      |

Table 6. Effect of irrigation intervals and potassium levels in boll weight (g).

Table 7. Effect of irrigation intervals and potassium levels in seed cotton yield (t/ha).
consider one of the important strategic way of plant to turn to reproductive growth moreover decrease of water quantities. This result agree with Mutar [30], Oad [25] and Al-Khirillah [22], while did not agree with results of Honey [31], Siddiqui et al., [32], Hameed and Abood [33] and Abood et al., [17]. Potassium levels were effected significantly in seed cotton yield. The highest value (3.87 t/ha) with 23% increasing percentage when increasing from 0 to 340 kg K₂O/ha at first season and 3.71 t/ha by increasing to 280 kg K₂O/ha with 44% increasing percentage. Increasing seed cotton yield by increasing potassium level attribute to increasing symposium (Table 3) and total boll number (Table 4) and open boll number (Table 5) with increasing 3.8 t/ha for second season.

Generally can be show that increasing potassium level was associated significant increasing seed cotton yield under two weeks irrigation and the optimum potassium level ranged from 280-340 kg K₂O/ha. Potassium consider one of the important nutrient that own effect direct or indirect in vegetative and reproductive growth which reflected positively in seed cotton yield directly. Abood et al., [17] did not obtained same result trend while Yagmur et al., [15] obtained the highest seed cotton yield at 100 kg K₂O/ha. Significant interaction was attained between irrigation intervals and potassium levels for seed cotton yield. Irrigation at two weeks and 340 kg K₂O/ha was obtained the highest seed cotton yield about 4.39 ton/ha which did not differed from same irrigation interval but 400 kg K₂O/ha gave (4.21 t/ha) at first season, while irrigation at two weeks and 280 kg K₂O/ha was attained the highest seed cotton yield about 3.8 t/ha at second season. Generally can be show increasing potassium level had associated significant increasing seed cotton yield under two weeks irrigation and the optimum potassium level ranged from 280-340 kg K₂O/ha.

### 3.8. Ginning Percentage

Irrigation intervals and potassium levels were effected significantly in ginning percentage (Table 8). Ginning percentage was increased significantly from 31.8 to 37.47 with 15% increasing percentage at two weeks interval irrigation at first season. Increasing ginning percentage with increasing irrigation interval attribute to increasing seed cotton yield (Table 7). Mutar [30] and Al-Khirillah [22] obtained same results, that two weekly irrigation interval gave the highest ginning percentage about 21.14%. But Lee et al., [34], Honey [31] and Sahito et al., [35] were found irrigation at 21 days (three weeks) had attained the highest ginning percentage about 33.86%. Associated increasing potassium levels significant increment of ginning percentage in both seasons. It was reached the highest value (39.5%) with 19% increasing percentage at 280 kg K₂O/ha compare with no potassium at first season and 42.5% with 15% increasing percentage but did not differ significantly with 340 kg K₂O/ha (41.33%) at second season. Increasing ginning percentage with increasing potassium level attribute to increasing seed cotton yield (Table 7). Yagmur et al., [15] he found that applied 100 kg K₂O/ha was gave the highest ginning percentage. Significant interaction was attained between irrigation interval and potassium levels at first season. The highest ginning percentage (43.67%) was obtained under two weeks intervals with 280 kg K₂O/ha. Can be show clearly increasing potassium levels attained increasing of ginning percentage at each irrigation interval, it refer to importance rolr of potassium especially under irrigation regime to increasing ginning percentage, therefore could be consider potassium application one of active strategic to increasing ginning percentage.

| 2010 K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean | 2011 Irrigation weekly | Irrigation at tow weeks | Mean |
|------------------|-------------------|------------------------|------|------------------------|------------------------|------|
| 0                | 31.00             | 32.67                  | 31.83| 36.00                  | 36.33                  | 36.17|
| 220              | 31.67             | 38.33                  | 35.00| 38.67                  | 38.67                  | 38.67|
| 280              | 35.33             | 43.67                  | 39.50| 41.33                  | 43.67                  | 42.50|
| 340              | 29.67             | 34.33                  | 32.00| 41.33                  | 41.33                  | 41.33|
| 400              | 31.33             | 38.33                  | 34.83| 37.33                  | 37.33                  | 37.33|
| l. s. d 5%       | 3.20              | 1.92                   | n. s | n. s                   | 2.40                   |      |
| Mean             | 31.8              | 37.47                  | 38.93| n. s                   | 39.47                  |      |
| l. s. d 5%       | 3.80              | n. s                   |      | 2.0                    |                       |      |

### 3.9. Water Use Efficiency (WUE)

| 2010 K₂O (kg/ha) | Irrigation weekly | Irrigation at tow weeks | Mean | 2011 Irrigation weekly | Irrigation at tow weeks | Mean |
|------------------|-------------------|------------------------|------|------------------------|------------------------|------|
| 0                | 0.22              | 0.20                   | 0.21 | 0.29                   | 0.31                   | 0.30 |
| 220              | 0.26              | 0.25                   | 0.26 | 0.34                   | 0.35                   | 0.35 |
| 280              | 0.36              | 0.38                   | 0.37 | 0.37                   | 0.37                   | 0.36 |
| 340              | 0.33              | 0.32                   | 0.33 | 0.33                   | 0.44                   | 0.39 |
| 400              | 0.27              | 0.31                   | 0.29 | 0.32                   | 0.42                   | 0.37 |
| l. s. d 5%       | 0.12              | 0.01                   | 0.02 | 0.02                   | 0.01                   | 0.01 |
| Mean             | 0.29              | 0.29                   | 0.33 | 0.38                   |                       |      |
| l. s. d 5%       | n. s              | 0.2                    |      |                        |                       |      |
WUE was affected significantly by irrigation intervals and potassium levels (Table 9). It was increased significantly from 0.33 to 0.38 with 15% increasing percentage at two weeks irrigation interval at second season. This increment attributed to increasing seed cotton yield (Table 7). This result agree with Mutar [30] that WUE can be increased with decreasing irrigation times, also Al-Khirillah [22] reported that irrigation at each two weeks was gave superior result which gave WUE 1.11 kg/m³ by decreasing water quantity. The primary plant response to water deficit include partial or complete stomata enclosure to attain decreasing evapotranspiration and improve WUE [36, 37]. On the other hand can be explain decreasing WUE at control treatment attribute to increasing water quantity compare with its yield produced. Some other researchers found similar results such as Fushening [38], and Wang at el [37].

Potassium levels were effected significantly in WUE compare with no potassium. It was reached to 0.37 kg/m³ with 43% increasing percentage under 280 kg K₂O/ha at first season and 0.39 kg/m³ with 23% increasing percentage under 340 kg K₂O/ha at second season. Potential stimulate root growth and water absorption moreover it decrease soil moisture losses by decreasing evapotranspiration and increase plant water keeping ability and recently increasing WUE [39].

It was increased significantly from 0.33 increasing percentage under 280 kg K₂O/ha at first season and 0.39 increasing percentage under 340 kg K₂O/ha at second season. It was increased significantly from 0.33 increasing percentage under 280 kg K₂O/ha at first season and 0.39 increasing percentage under 340 kg K₂O/ha at second season. Potassium stimulate root growth and water absorption moreover it decrease soil moisture losses by decreasing evapotranspiration and increase plant water keeping ability and recently increasing WUE [39].

Significant interaction was obtained between irrigation intervals and potassium levels in WUE, it was reach the highest value 0.38 kg/m³ under two week interval irrigation with 280 kg K₂O/ha at first season and 0.44 kg/m³ at same irrigation interval and 340 kg K₂O/ha at second season. Generally can be show that increasing potassium level was associated rapidly increment in WUE at each irrigation interval and was reached climax value at 280-340 kg K₂O/ha. That refer to importance of potassium application especially under water regime, it seem the highest values were attained under two week irrigation interval.

Recently can be conclude irrigation at two weeks one of the important strategic way to attain the highest seed cotton and ginning percentage which mean decreasing water irrigation quantity to half and exploitation in cultivation cotton in much areas, especially cotton consider summer crop and water one of critical factors in growing and production. Increasing potassium level to 280 kg/ha was attained the highest seed cotton and ginning percentage but any increasing potassium level be not economic due to the highest cost value of fertilizer, so that can be recommend to applied 280 kg K₂O/ha under two week irrigation interval to attain the highest seed cotton and ginning percentage for Lashata cultivar cotton at central region condition of Iraq.

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