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Effect of cyanide potassium on sorghum and wheat germination

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Abstract. For increasing growth and yield in plants one of ways is inhibiting of cyanide-resistance respiration. This Research was performed in laboratory of Islamic Azad University Maybod Branch-Iran in 2010. This experiment was carried out on *sorghum and wheat* in germination and seedling stages in a completely randomized design with three replications. Treatments were included KCN levels (0, 0.0001, 0.0005, 0.001 and 0.005 M). The following measurements was carried out: germination rate germination percent, seedling dry weight, cyanide resistant index, germination index, 5% germination rate (the time it takes 5% of seeds to germinate), 50% germination rate (the time it takes 50% of seeds to germinate) and 90% germination rate (the time it takes 90% of seeds to germinate). The maximum seedling dry weight of wheat was detected in concentration of 0.0001 that was not significant different with control group and the minimum was observed in 0.005M KCN (0.25 mg) that was not different with concentration of 0.001 M. (figure1). According to table of comparing of means the highest seedling group and the lowest related to 0.005M. According to table of comparing of means the highest percentage related to the control (56.03%) that was not different with 0.0001M and the lowest related to the 0.005M (25.36%). There was no significant difference in germination percentage of sorghum at concentrations of KCN. (table1). So KCN du to reduce germination of wheat and KCN has no roll in sorghum.

Keywords: cyanide potassium, wheat, sorghum, germination percentage

1. Introduction

If cyanide (1mM) be added to the tissues of animals, cytochrome oxidize will be stopped and respiratory rate will reach to less than one percent of its basic value. Most of plant tissues resist on cyanide, so that in the presence of cyanide, respiration rate reaches to 25% and sometimes to 100% than normal respiration rate. Responsible enzyme for oxygen absorption in these cases is known as cyanide-resistant oxidize in respiratory chain of plant mitochondria (Siedow and Berthold, 1986).In this pathway, electrons from main respiratory chain deviate to alternative pathway. Since electrons deviate from ubiquinone (Q) to alternative pathway, therefore, at least two sources of generating energy (2ATP) will not be considered. If the electrons flow in the alternative pathway, the produced energy assumed for producing ATP, will be wasted as heat. Cyanide-resistant oxidase will be inhibited by special compounds such as SHAM. In some plants, such as *Araceae*, the alternative pathway will be increased before pollination, which this increasing of respiration rate causes the inflorescence temperature increases 14°C than environmental temperature (Raskin et al., 1989). It should be mentioned, that in most plants the cyanide-resistant respiration rate is too low that they do not produce noticeable heat. Lambers (1985) believed that this alternative pathway acts as an overflow and it oxide respiratory substrates which are more than what is needed for growth. From this perspective, electrons will be entered into the alternative pathway only after saturation of the capacity of the main pathway. Such a thing, in vitro, will occur after the addition of cyanide. Ferguson et al. (1985) considered the effect of low temperature and respiratory inhibitors on calcium flux in mitochondria of avocado fruits. Unlike many studies that show KCN decrease the produced energy and also inhibit Ca^{++} uptake (such as studies about corn, mung bean and potato (Dieter and Marme, 1980; Ralph and Wojik, 1982 and Russell and

Wilson, 1978)) in Ferguson's study, KCN clearly stimulate Ca^{++} uptake. Also, comparing to 25°C, 5°C partially increases Ca^{++} uptake. According to different results of using cyanide in plants, this study was done to consider the resistance or sensitivity of *sorghum and wheat* in germination stages .

2. Materials and methods

This Research was performed in laboratory of Islamic Azad University Maybod Branch-Iran in 2010. This experiment was carried out on *sorghum and wheat* in germination and seedling stages in a completely randomized design with three replications. Treatments were included KCN levels (0, 0.0001, 0.0005, 0.001 and 0.005 M). After preparing different concentrations of KCN, pH of all solutions with HCL (1N) and NH_4OH (1N) reached to 7 (such as distilled water). Seeds were germinated on filter papers placed within 10 cm diameter plastic dishes. Seeds were sterile with NaOH 5% for 10 min and then washed carefully. Germination dishes (20 seeds per dish) were placed within controlled chambers. Experiment was carried out at 20°C. Seeds were considered germinated when radicles were ≥ 3 mm long. Germinated seeds were counted daily until seven days.

The following measurements was carried out: germination rate (was calculated by the equation of Maguire (1962) germination percent, seedling dry weight, cyanide resistant index, germination index, 5% germination rate (the time it takes 5% of seeds to germinate), 50% germination rate (the time it takes 50% of seeds to germinate) and 90% germination rate (the time it takes 90% of seeds to germinate). The germination data were subjected to statistical analysis using the SAS system. All percentage data were modified according in arcsine for analysis. Finally, Duncan multiple range test was applied to compare the means at $p<0.05$.

3. Results and discussion

3.1. Effect of KCN on seedling dry weight

Based on statistical analysis, there was significant difference in the seedling dry weight between concentrations of KCN in both of plant. The maximum seedling dry weight of wheat was detected in concentration of 0.0001 that was not significant different with control group (1.7 mg) and the minimum was observed in 0.005M KCN (0.25 mg) that was not different with concentration of 0.001 M. According to table of comparing of means the highest seedling group and the lowest related to 0.005M.

3.2. Effect of KCN on cyanide- resistant index

Analysis of variance showed that there was significant different in the seedling weight between different concentration of KCN in both of plant. The maximum STI of wheat related to concentration of 0.0001M that was not significant different with control of experiment and the minimum of STI related to 0.005M.

According to comparing of means in sorghum the maximum of STI is in concentration of 0.0005M that was not different with concentration of 0.0001M and the minimum of STI is in 0.005M.

3.3. Effect of KCN on germination percentage

Results showed that the germination percentage was significant in wheat. According to table of comparing of means the highest percentage related to the control (56.03%) that was not different with 0.0001M and the lowest related to the 0.005M (25.36%). There was no significant difference in germination percentage of sorghum at concentrations of KCN. So KCN du to reduce germination of wheat and KCN has no roll in sorghum.

3.4. Effect of KCN on the 90% germination rate

The result of ANOVA showed the significant effect of KCN on 90% germination rate at wheat between different groups. The highest average rate in concentration of 0.005M and the lowest average was related to the 0.0001M that was not different with control at experiment. The result of sorghum show same results, but the lowest 90% germination rate related to 0.0005M that was not significant different with control and 0.0001M. .

3.5. Effect of KCN on the 5% germination rate

5% germination rate is one of the qualities that can be used for comparing the rate of initial germination of plants. The plant which can germination faster and is more vigor, it has a better chance too. There was significant different in 5% germination rate of wheat in between treatment. The maximum 5% germination rate related to 0.005 and the minimum 5% germination rate is in concentration of control group. According to table at ANOVA of sorghum is significant different between treatment. The highest 5% germination rate is in the concentration of 0.005 that was not different with 0.001M and the lowest rate related to concentration of 0.0005M.

3.6. Effect of KCN on germination rate

The result of the germination rate showed there was a significant different between groups using KCN concentration in both of plants. According to table of comparing of means the maximum germination rate of wheat related to control group that is not different with 0.0001M and the minimum rate is in concentration of 0.005M.The highest rate of germination was related to concentration of 0.0005M that was not different with control of experiment and concentration of 0.0001M and the lowest amount of rate is in concentration of 0.005M.

3.7. Effect of KCN on the 50% germination rate

There were significant different between groups using different concentrations of KCN in both of plants. The highest rate of wheat was related to the concentration of 0.0005M (148) that was not different with 0.001M. The maximum rate of sorghum is in the concentration of 0.005M that was not significant different with 0.001 and the minimum rate related to concentration of 0.0005M.

3.8. Effect of KCN on the elongation shoot

Analysis of variance showed the KCN has no role in elongation shoot in sorghum note the highest elongation shoot in wheat so that the lowest elongation shoot relate to the control group the was not significant different with 0.0001M and the lowest related to 0.005M the was not different with concentration of 0.0005M.

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