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EFFECT OF WATER QUANTITY AND COVERAGE ON SEEDS GERMINATION AND THEIR EMERGENCE IN WHEAT CROP *TRITICUM AESTIVUM* L.

Hayder A.A. Al-Shebly[1]*, Fadhil K.K. Al-Ebrahemi [2] and Amel A. Ali[3]

[1*]Department of Technology of Medical Laboratory Imam Ja,afar Al - Sadiq University, Najaf, Iraq.
[2]Department of Biology, College of Sciences, University of Kufa, Najaf, Iraq.
[3]Department of Plant Protection, College of Agriculture, University of Kufa, Najaf, Iraq.

Abstract

Present study was carried out in Dept. of Biology, College of Sciences/University of Kufa for the period from 10-1-2017 to 3-3-2017 to study effects of two factors; quantity of water utilized for irrigation of wheat seeds at three levels (50, 100 and 150 ml/kg soil) and type of mulching (no mulch, transparent and black plastic mulching) on seed germination and seedlings growth of wheat plant at completely treatments with three replicates. Seed germination rates at different treatments were determined 10 days post planting. The other growth indicators (plant height, root length, numbers of branches/plant, leaves/plant, fresh and dry weight) were recorded 50 days post planting. Results indicated that the irrigation with 100 ml water/kg soil, mulching with black plastic and their interaction resulted in the highest germination rates which did not differ from interaction treatment of 150 ml water/kg soil and coverage with transparent polythene. The quantity of 150 ml water/kg soil and transparent plastic mulch individually or combined were the most effective treatments resulting in increasing values of all the studied plant growth indicators.

Key words : Water quantity, seeds germination, *Triticum aestivum* L., mulching.

Introduction

Wheat is at the forefront of grain crops used by humans in food, it is the most prevalent in the ground. The northern part of Iraq is most important agricultural areas, where the soil moisture is the specific factor for the growth and production of wheat. These areas may be exposed to mild rain that sufficient to seed germination. The rain then may stop for long period, causing a drop in the proportion of seedling emergence and increasing seedling death due to drought (Al-Musawi.2016).

There are multiple environmental factors effect on germination and early growth of the plant, the most important of these factors are humidity, temperature and oxygen, as well as, with less effects, abundance carbon dioxide and light (Al - Badairi.2013). The water must be abundant especially at early stage of planting for efficient seed germination. Seed weight during germination process showed significant increase to be 200% approximately (Al-Ebrahemi.2015). This increase in seed weight is mainly due to water absorption within the seeds (Agricultural Satistics, 2010). Water at sufficient amounts is also important in germination as softening agent that helps breaking down and moisturizing the bran layers, and thus facilitates water and oxygen to the endosperm and embryo for germinating because softens. Water can help enzymes to stimulate physiological processes and nutrients transport through plant tissues. However, massive amounts of water due to over irrigation may highly reduce oxygen availability. Oxygen deficiency delays seed germination and thus causes seed rot and seeds in this case are often attacked by soil born bacteria especially those prefer conditions with low oxygen concentration (Al-Musawi, 2016 and Winter, 1970). Since temperature is a key factor in seed germination, the cover or mulching would be not only effective for raising the temperature of seeds environment but also reducing evaporation and maintaining humid condition that helps seed germination. The seeds were found to grow but

***Author for correspondence :** E-mail : haiderazizali0@gmail.com

could then fail due to insufficient soil moisture or low temperatures (Hamza, 2011; Powell, 2006). In order to determine the effect of the interaction between the amount of water given for seed germination and seedling emergence, and soil cover in the early stages of growth thus present study was conducted.

Materials and Methods

A two factor experiment based on randomized completely block design RCBD with three replicates was carried out to determine the effect of water quantity sufficient for seed germination of seedling emergence as well as type of plastic mulching (black or transparent) in the early growth of wheat plants. The IPA-95 (certified wheat variety) used in this study was provided by Najaf Agriculture Directorate. The soil used for germination was sandy soil brought from a field in desert region between provinces of Najaf and Kerbala. The soil was sifted and distributed into 2kg no-drain holes plastic pots (25cm dia. and 10cm depth). Each pot was sown with 100 (as uniform as possible) wheat seeds and irrigated according to treatments. Treatments were amount of water used for irrigation at three quantity levels (50, 100 and 150 ml/kg soil) and coverage (mulching) with either transparent or black polythene while uncovered pots served as control treatment. For all the treatments, pots were irrigated at the day of planting and for second time at 5 days post the planting. After 10 days of planting, plastic mulch was removed from the covered treatments and seed germination rates were recorded. Plants were thinned to be 60 plants/replicate. Irrigation continued according to the treatment quantity every 10 days interval. After each irrigation ten plants were removed from each replicate to be 20 plants at the end of the experiment (50 days post planting). The experiment was ended and plant growth indicators including plant height (cm), root length (cm), number of branches per replicate and leaf plant^{-1}, leaf area (cm^2) and fresh and dry weigh (g) were recorded. All the recorded data were subjected to analysis of variance ANOVA. Means were compared among treatments and Duncan's multiple range tests were performed where appropriate at 0.05% probability (Al-Rawi, 2000).

Results and Discussion

The results showed that the treatment of transparent or black plastic mulch for ten days produced the highest percentage seedlings emerged (germination rates). Irrigation with 100 ml water/kg soil resulted in the highest values of growth parameters compared to 50 or 150 ml/kg of soil (Table 1). Interaction of the two former treatments exceled all the other individual or combined treatments in germination rate while interaction of no mulch and 50 ml/kg soil irrigation water recorded the lowest rate of seed germination (Table1). Interaction between the two factors indicated that transparent plastic mulch with irrigation quantity of 100 or 150 ml/kg soil resulted in the highest values of plant height (Table 1) and root length table 2 especially at the highest rate of irrigation compared to the shortest plants and root systems resulted from no mulch treatment at irrigation level of 50 ml/kg soil. The same interaction treatment of 150 ml/kg soil and transparent mulch also resulted in significantly higher values in number of leaves (4.30 leaf.plant^{-1}) (Table 2) and branches (0.570 branches.plant^{-1}) per plant, largest leaf area (6.30 cm^2) (Table 3) and heaviest plant fresh and dry weights (410 g and 62 g) compared to significantly the lowest values which were always resulted from the interaction treatment of no mulch and 50 ml/kg soil irrigation water.

The decrease in germination and eruption in treatments with higher amounts of water, especially under cover, is due to lack of oxygen. The accumulation of water in the space between the endosperm and the bran after irrigation affects physiological processes during early stages of growth. Increasing the humidity level for a short period followed by a relatively quick dry period leads to damage the seed embryo and consequently low germination rate. Because the process of impregnation is rapid as well as the permeability of water through the membranes leads to faster enzymatic activities leading to the rupture of the seed casing death before germination.

The results showed that coverage (mulching) during the early period of planting also led to increase in plant vegetative and root growth indicators. Covering the soil with black or transparent plastic resulted in relatively high temperature in the environment under the cover, preserving moisture for a longer period and acting as antagonistic environment to weed seeds (Al-Shebly, 2017; Hamza, 2011; Wien, 1997 and Winter 1970). For this reason, plants of seeds grew under the mulch were significantly faster growing and had higher growth indicators. It was shown that such processes help to change the root growth environment and increase soil temperature from 1 to 10 C°, this change helps to increase the growth of roots and increase their ability to absorb water and nutrients, which in turn reflected on growth indicators in general (Al-Ebrahemi, 2014).

As for water quantity effect, increase in water and moisture level increases plant cell activities including cell swelling, enlargement and division. This will definitely increase all the studied plant growth parameters including plant height, root length, numbers of branches/plant,

Table 1: Effect of coverage type and water quantity on seed germination rate and plant height of wheat plant *Triticum aestivum*.

Seed germination %					Plant height (cm)				
Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	Average	Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	Average
50	53.00 e	71.00 d	76.00 b	66.67 b	50	5.72 f	12.80 b	11.80 c	10.11 c
100	74.00 c	84.00 a	83.00 a	80.33 a	100	9.16 e	13.50 b	12.76 b	11.81 b
150	76.00 b	77.00 b	76.00 b	76.33 c	150	9.56 d	13.96 a	12.83 b	12.12 a
Average	67.67 c	77.33 b	78.33 a		Average	8.15 c	13.42 a	12.46 b	

Values are means of three replicates. Means that have same letter(s) within column are not significantly different according Duncan's multiple range tests ($P \leq 0.05$).

Table 2: Effect of coverage type and water quantity on root length and number of leaves per plant of wheat *Triticum aestivum*.

Root Length (cm)					No. of leaf plant^{-1}				
Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	Average	Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	Average
50	9.33 i	17.20 c	15.16 f	13.90 c	50	2.60 de	3.40 e	2.70 d	2.90 b
100	12.20 h	17.40 c	15.10 f	14.90 b	100	2.80 d	4.00 a	3.00 b	3.27 a
150	11.90 h	21.70 a	19.26 b	17.62 a	150	2.90 c	4.30 a	2.70 d	3.30 a
Average	11.14 c	18.77 a	16.51 b		Average	2.77 b	3.90 a	2.80 b	

Values are means of three replicates. Means that have same letter(s) within column are not significantly different according Duncan's multiple range tests ($P \leq 0.05$).

Table 3: Effect of coverage type and water quantity on number of branches per plant and leaf area of wheat *Triticum aestivum*.

No. of branches plant^{-1}					Leaf area (cm^2)				
Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	% Mean of water amount	Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	% Mean of water amount
50	0.170 f	0.370 c	0.270 e	0.270 c	50	1.50 i	5.10 d	4.30 f	3.63 b
100	0.370 c	0.570 a	0.370 c	0.437 b	100	2.90 h	6.40 a	5.30 c	4.87 a
150	0.470 b	0.570 a	0.370 c	0.470 a	150	3.70 i	6.30 b	4.90 e	4.97 a
Mean of coverage	0.337 b	0.503 a	0.337 b		Mean of coverage	2.70 c	5.93 a	4.83 b	

Values are means of three replicates. Means that have same letter(s) within column are not significantly different according Duncan's multiple range tests ($P \leq 0.05$).

Table 4: Effect of coverage type and water quantity on plant fresh and dry weight of wheat *Triticum aestivum*.

Fresh weight (g)					Dry weight (g)				
Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	% Mean of water amount	Quantity of water(ml/kg)	%Without coverage	%Transparent coverage	%Black coverage	% Mean of water amount
50	233.00 e	299.00 b	296.00 b	276.00 c	50	39.00 i	52.00 de	48.00 fg	46.33 c
100	255.00 c	407.00 a	313.00 b	325.00 b	100	41.00 h	53.00 cd	55.00 b	49.67 b
150	260.00 c	410.00 a	395.00 a	355.00 a	150	49.00 f	62.00 a	54.00 bc	55.00 a
Mean of coverage	249.33 c	372.00 a	334.67 b		Mean of coverage	43.00 c	55.67 a	52.33 b	

Values are means of three replicates. Means that have same letter(s) within column are not significantly different according Duncan's multiple range tests ($P \leq 0.05$).

leaves/plant, fresh and dry weight (ALobaidy, 2016). While, low water availability decreases ability of plant enzymes in proteins synthesis leading to plants with low content of total protein which explain the low fresh and dry plant weights.

Similarly, other researches (Al-shebly, 2017, Fuller, 1977, and Al - Badairi, 2013) revealed that water content for soil (soil humidity) affected on some physiological processes of crop plants, they found that plant height, leaf area, provided of nutrients, protein synthesis, chlorophyll percentage and carbohydrates were negatively affected in soil with low content of water. Therefore present study showed that coverage of seeds with clear plastic and irrigated with water at amount of 100-150 ml/kg soil helped to raise the percentage of seedling emerged and increased vegetative and root growth of wheat plants 50 days post planting.

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