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Effects of Different Water and Nitrogen Treatments on Corn

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Abstract

This paper studied the effects of different water and nitrogen treatments on corn growth, dry matter quality and yield through field experiments in the Heilonggang watershed. The experiment set the two factors of irrigation amount and nitrogen application, and the irrigation amount was set to full irrigation (W4: irrigation amount is 1.0 I) and deficit irrigation (W3: 0.85 I, W2: 0.7 I, W1: 0.55 I), a total of 4 irrigations Level, 3 nitrogen levels (low nitrogen N1: 180 kg/hm2, medium nitrogen N2: 240 kg/hm2, high nitrogen N3: 300 kg/hm2), a total of 12 treatments. The results showed that W4N1 and W4N2 treatments had the highest plant heights at the seedling stage and jointing stage, which were 69.57 cm and 156.17 cm, respectively. The W3N3 treatment had the highest plant height at 265.57 cm at the heading stage and W2N2 treatment at the filling stage The highest height is 265.17 cm. The treatments with the best stem thickness at the seedling and jointing stage were W3N3 treatments, which were 16.64 mm and 29.96 mm, respectively. The treatments with the largest stem thickness at the heading and filling stage were W4N2 treatments, which were 26.23 mm and 26.27 mm, respectively. The maximum fresh weight and dry weight yield were both treated with W4N2, which was 10.94% and 37.01% higher than that of W4N1 and W4N3 treatments, and 9.63% and 25.10% higher than that of W4N1 and W4N3 treatments. The treatment with the highest grain yield was the W4N2 treatment, which was 9.84t/hm2, which was 7.42% and 14.23% higher than that of W4N1 and W4N3 treatments, respectively. The experiment showed that under the condition of full irrigation and 240 kg/hm2 nitrogen application, it can improve silage jade. The best treatment for plant height, stem thickness and yield.

Keywords

Silage Maize; Water and Nitrogen Interaction; Yield.

1. Introduction

In China, there is a serious shortage of water resources, and the per capita water consumption is only a quarter of the world per capita. There are also uneven regional distribution and mismatch of water and land resources; problems such as uneven inter-annual distribution during the year[1-3]. As a large agricultural country, China will face more severe pressure on water resources and food security. Therefore, improving water productivity plays an important role in the rational use of water resources and food security in my country [4]. Excessive fertilization not only reduces fertilizer utilization, but also increases the loss of soil nutrients and causes environmental pollution. Therefore, the method of reducing fertilizer input while maintaining or even increasing crop yield is a major goal of crop research [5,6]. Therefore, increasing the grain yield while reducing the damage and impact on the environment and promoting the rational use of water resources are issues that my country's agriculture needs to solve urgently.

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The plant height and stem thickness of crops are the basic indicators that directly reflect the growth and development of crops. Bassou Bouazzam [7] et al. studied the growth of silage maize by water stress and found that water deficit affects the height growth of silage maize and reduces the leaf area index. Accelerated the premature aging of the leaves. Zhang Fucang [8] et al. showed that the single factor of irrigation amount and fertilization amount has a significant or extremely significant impact on corn plant height, stem thickness, and LAI, and the coupling effect of irrigation amount and fertilization amount has an extremely significant impact on corn plant height. Irmak [9] found through research that moderate deficit irrigation will not reduce corn productivity and effectively reduce the problem of insufficient irrigation water in arid areas. The research of Donk [10] showed that giving moderate water stress to corn during the period when the water demand is not critical will not affect its yield but increase the water use efficiency. Karasu [11] believes that deficit irrigation reduces grain yield and yield components, but improves the utilization rate of irrigation water. Aslam [12] found that the increase in nitrogen application rate not only increased the corn stem thickness but also increased the fresh weight of the plant, and the dry matter yield and feed yield increased significantly. This experiment explores the influence of different water and nitrogen treatments on the growth and yield of corn in a typical semi-arid and semi-humid area of the Heilonggang River Basin, and provides theoretical basis and technical support for determining the water and fertilizer management system of corn in this area with water and nitrogen reduction and stable yield.

2. Materials and methods

2.1 Overview of the test area

The experiment was carried out at the Comprehensive Experimental Station (37°34′51″ N, 115°13′24″ E, 28.5 m above sea level) of Hebei Agricultural University in Julu County, Heilonggang Basin, from May to September 2020. The multi-year average temperature of the station is 13.3°C, the multi-year average sunshine duration is 2767.4 hours, the frost-free period is 202 days, and the multi-year average rainfall is 509 mm. The rainfall is mainly concentrated in June to August, and the groundwater depth is about 40 m. Test surface soil organic matter content 8.967 g/kg, total nitrogen 0.540 g/kg, total phosphorus 0.892 g/kg, total potassium 22.690 g/kg, alkali hydrolyzed nitrogen 33.17 mg/kg, available phosphorus 1.82 mg/kg, available potassium 169.32 mg/kg. Meteorological data during soybean growth period was measured by Tianqi Intelligent Ecological Meteorological Station (ET007, Dongfang Zhigan (Zhejiang) Technology Co., Ltd., Hangzhou). The main meteorological elements during the test period are shown in Figure 1. The basic properties of the soil are shown in Table 1.

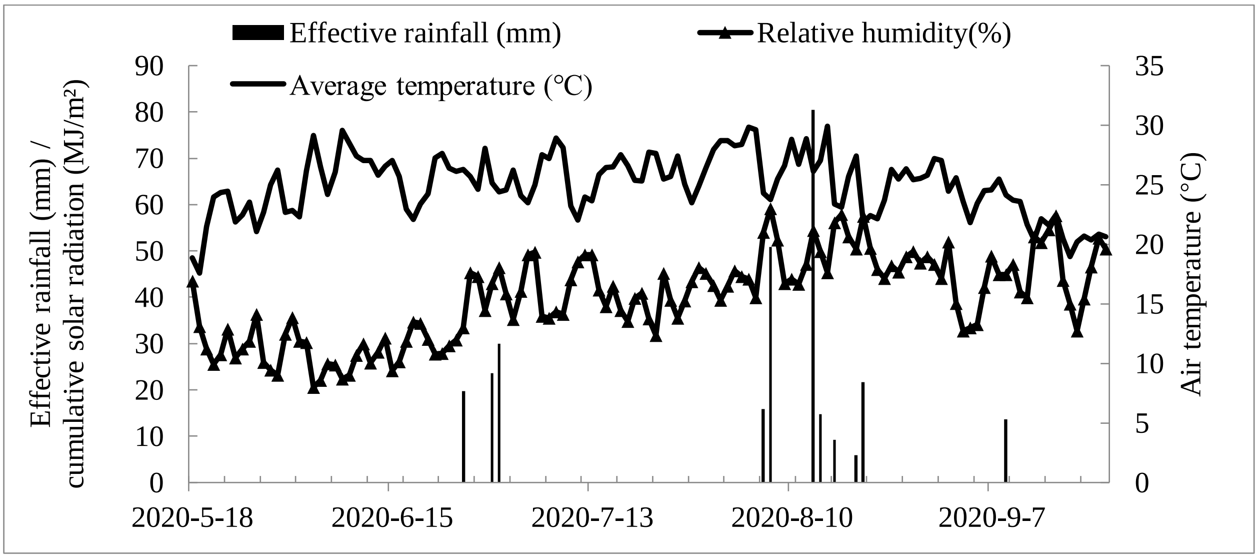

Figure 1. Changes of main meteorological elements during the growth period of corn

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Table 1. Basic soil properties of the test site

Soil depth (cm)	Soil particle size distribution			Soil bulk density γ (g / cm3)	Field water holding capacity θf (V / V,%)
	Sand%	Powder%	Clay%		
0~10	55.59	41.57	2.84	1.41	0.295
10~20	55.59	41.57	2.84	1.39	0.29
20~30	42.84	53.73	3.43	1.36	0.305
30~40	50.4	45.94	3.66	1.36	0.341
40~50	53.5	43.35	3.15	1.37	0.375
50~60	42.44	53.15	4.41	1.41	0.375
60~70	48.07	47.66	4.27	1.46	0.395
70~80	70.02	27.31	2.67	1.38	0.376
80~90	60.93	35.28	3.79	1.38	0.391
90~100	32.39	63.33	4.28	1.41	0.309

2.2 Experimental design

The experiment was conducted at the Comprehensive Experimental Station of Hebei Agricultural University, Julu County, Hebei Province. According to the two factors of corn growth design, irrigation and nitrogen application, the tested variety is Hengyu321. The irrigation method is border irrigation, and the irrigation volume is 4 levels. The amount of water to be fully irrigated is when the soil moisture content reaches 75±2% (seedling stage), 75±2% (joining stage, heading stage, filling stage), the amount of water irrigated to 95% of the field holding is I. The four irrigation levels are 100% I, 85% I, 70% I, and 55% I. The nitrogen application rate is divided into 3 levels, namely 180, 240, and 300 kg/hm2 nitrogen. Phosphate fertilizer 150 kg/hm2, potash fertilizer 150 kg/hm2. There are a total of 12 treatments in the experiment, with 3 replicates for each treatment, for a total of 36 cells. The area of the plot is 4 m×4 m, with 0.5 m protective belts on each side. The planting row spacing is 50 cm, the plant spacing is 25 cm, and the planting density is 80,000 plants/hm2. The soil bulk density and field water holding rate in the test area were taken from the soil. The nitrogen fertilizer applied before sowing was 40% of the total nitrogen applied in each treatment. Phosphate and potassium fertilizers were applied at one time, and the remaining 60% nitrogen fertilizer was used in the early and large corn jointing. 60% and 40% are applied during the flare period.

Table 2. Field test plan for corn

treatment	Irrigation volume	Nitrogen application rate(kg/hm2)	Phosphate fertilizer(kg/hm2)	Potash fertilizer(kg/hm2)
W1N1	55%I	180	150	150
W1N2	55%I	240	150	150
W1N3	55%I	300	150	150
W2N1	70%I	180	150	150
W2N2	70%I	240	150	150
W2N3	70%I	300	150	150
W3N1	85%I	180	150	150
W3N2	85%I	240	150	150
W3N3	85%I	300	150	150
W4N1	I	180	150	150
W4N2(CK)	I	240	150	150
W4N3	I	300	150	150

2.3 Test items and methods

2.3.1 Growth indicators

After the maize emerges, the plant height and stem thickness are measured every 7-10 days (3 plants listed on each plot).

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(1) Plant height: The plant height is measured with a steel tape with an accuracy of 1mm. The plant height before tasseling is the distance from the ground to the highest leaf tip that erects all unfolded leaves vertically, and the plant height after tasseling is the distance from the ground to the top of the ear .

(2) Stem thickness: measured with a vernier caliper with an accuracy of 0.01mm. The cross-section of the stalk of corn is elliptical. First, clamp the widest part of the stem with a vernier caliper to measure and read the value, and then rotate the caliper 90 degrees to measure and read again A numerical value. Two values are read for each plant. Use the ellipse area formula to calculate the cross-sectional area of the stem, and then convert it to the diameter of a circle with the same cross-sectional area as the stem thickness. The position of each measurement needs to be fixed (measure the stalk 10cm from the ground).

2.3.2 Dry matter quality and distribution

The aboveground biomass of corn at the end of the filling stage, 3 plants were randomly selected from each plot, and the plants were divided into stems (including stems and sheaths), leaves (including green leaves and dead leaves), and ears (corn ears including bracts, Axes and kernels). After weighing the fresh weight, place the plant sample in a file bag, preheat it to 105°C in an electric blast drying oven, and then dry it at 105°C for 30 minutes and then bake it to constant weight at 75°C.

The calculation formulas for stem distribution coefficient (PIs), leaf distribution coefficient (PIl), and ear distribution coefficient (PIe) are as follows:

$$PI_s = \frac{S_{drymass}}{S_{drymass} + L_{drymass} + E_{drymass}}$$

$$PI_l = \frac{L_{drymass}}{S_{drymass} + L_{drymass} + E_{drymass}}$$

$$PI_e = \frac{E_{drymass}}{S_{drymass} + L_{drymass} + E_{drymass}}$$

In the formula, Sdrymass is the dry weight of stems (g), Ldrymass is the dry weight of leaves (g), and Edrymass is the dry weight of ears (g).

2.3.3 Corn kernel yield

Harvest all ears except the side rows of the plot. After the ears of corn are air-dried for 2-3 months, they are manually threshed, and the weight of each ear of corn is weighed. At the same time, the drying method (temperature 105℃, drying 8h) is used to determine the moisture content of corn kernels, and finally the yield of corn is calculated according to the mass moisture content of 14%.

2.4 Data processing

Use Microsoft Excel 2010 (Microsoft Corp., WA, USA) for data analysis and icon production, and use IBM SPSS Statistics 22 (IBM Corp., NY, USA) for significance analysis ($P<0.05$ is significant, $P<0.01$ is extremely Significant), single and double factor analysis of variance.

3. Results and analysis

3.1 The effect of different water and nitrogen treatments on the growth dynamics of corn plant height

Plant height is one of the important characteristic indexes reflecting crop growth traits, and crop plant height growth traits determine yield

How much and the quality. The main effects of different water and nitrogen treatments on the plant height of corn are shown in Figure 2. It can be seen from Figure 2 that silage maize exhibits an "S"-shaped growth during the growth period. The growth in the seedling stage is relatively slow, the growth in the jointing stage is significantly accelerated, and the growth rate at the heading stage is significantly slowed down. Growth, the growth of corn at the filling stage tends to be stable, and

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basically no longer grows. The reason for the slight decline is that the tassel loses water and dries out and the plant height decreases. Analysis of the main effects of different irrigation amounts showed that the plant height of W3 treatment was the highest, 255.98cm, which was higher than that of W1, W2 and W4 treatments by 2.66%, 1.08% and 3.01% respectively. According to the analysis of the main effects of different nitrogen application treatments on the plant height of silage maize, the best nitrogen application treatment is N2 treatment, the highest plant height is 259.95cm, which is 8.03% and 4.03% higher than N1 and N3 treatments respectively.

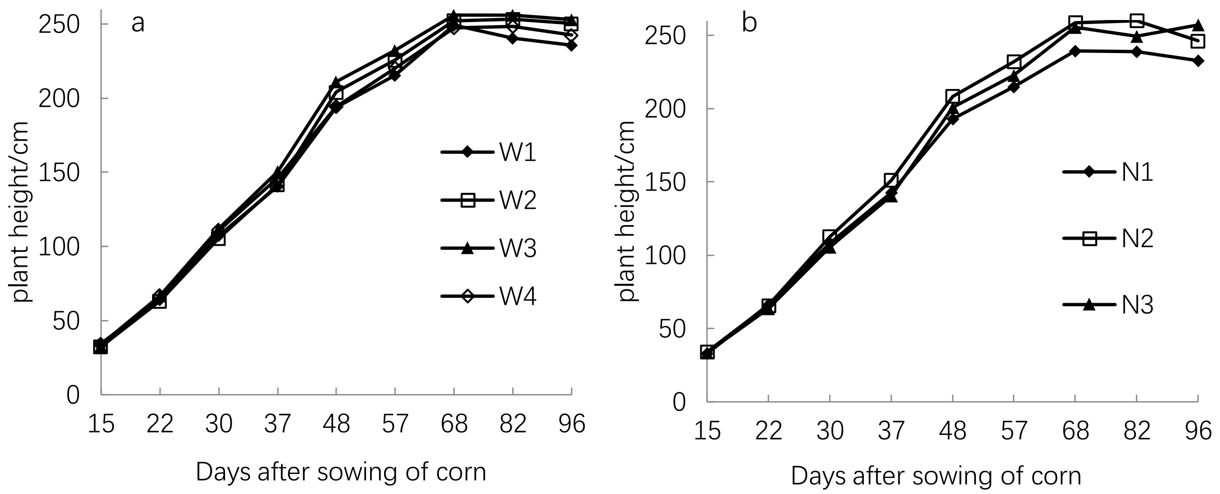

Figure 2. The main effects of different irrigation treatments and nitrogen treatments on the plant height of cornPlant heightPlant height

3.2 The effect of different water and nitrogen treatments on the plant height of corn in each growth period

Table 3 shows the effects of different water and nitrogen treatments on the plant height of silage maize at the seedling stage, jointing stage, heading stage and filling stage. It can be seen that different treatments have no significant effect on the plant height of corn in the seedling and heading stages, but significant differences appear in the jointing and filling stages. The increase of nitrogen application rate under W1 irrigation treatment inhibited the plant height of silage maize at the seedling stage, and the plant height increased with the increase of nitrogen application rate in other growth periods. Under W2, W3 and W4 irrigation treatments, with the increase of nitrogen application rate, the plant height of each treatment increased first and then decreased. During the heading stage and the filling stage, the stem thickness was changed to a certain extent due to the aging of the leaf sheath at the measuring position and even shedding. decline.

The highest plant height was 69.57 cm and 156.17 cm in W4N1 treatment and W4N2 treatment at seedling stage and jointing stage, while W3N3 treatment had the highest plant height at 265.57 cm at heading stage, and W2N2 treatment had the highest plant height at filling stage. It is 265.17 cm, which indicates that the greater the amount of irrigation and the amount of fertilizer, the higher the plant growth, the deficit irrigation and the appropriate amount of nitrogen in the early stage are more conducive to the growth of plant height in the later stage of silage maize. From the analysis of variance, different irrigation and nitrogen treatments at the seedling stage had no significant effect on the plant height of silage maize. During the jointing stage, the irrigation factors and the interaction of the two have a significant impact on plant height, and nitrogen application has a very significant impact on plant height. In both the heading stage and the filling stage, the application of nitrogen fertilizer has extremely significant differences in plant height, while irrigation and the interaction between the two have no significant effects.

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Table 3. Effects of different water and nitrogen treatments on plant height of corn

treatment		Seedling stage (cm)	Jointing period (cm)	Heading date (cm)	Grouting period (cm)
W1N1		67.77±5.58a	136.33±14.81ab	236.53±10.64a	203.03±12.3b
W1N2		63.47±6.72a	143.6±11.61ab	246.4±14.97a	251.9±10.05a
W1N3		60.7±3.58a	142.1±3.72ab	264.8±5.07a	252.63±11.36a
W2N1		59.43±6.57a	132.63±10.25b	237.97±11.76a	238.6±13.88ab
W2N2		65.13±2.08a	151.97±4.03ab	268.77±5.1a	265.17±4.21a
W2N3		65.1±5.67a	140.43±8.51ab	250.2±6.5a	247.13±16.94ab
W3N1		67.57±4.35a	150.13±3.88ab	245.93±13.77a	247.77±8.86ab
W3N2		65.33±2.37a	152.77±4ab	256.17±7.27a	256.43±7.94a
W3N3		67.2±1.87a	148.63±4.18ab	265.57±7.35a	254.7±7.95a
W4N1		69.57±2.97a	152.7±3.38ab	237.03±18.56a	242.13±11.22ab
W4N2		68.97±5.07a	156.17±4.49a	263.5±16.64a	254.87±6.41a
W4N3		62.4±2.43a	130.53±6.65b	242.07±23.12a	230.6±8.81ab
F value	W	1.64ns	3.261*	0.721ns	2.192ns
	N	0.873ns	6.567**	7.701**	7.14**
	W*N	1.766ns	3.184*	1.826ns	2.315ns

Note: The data is the average ± standard deviation of 3 sample squares, lowercase letters indicate significant differences at P=0.05, * indicates significant differences (P<0.05), ** indicates extremely significant differences (P<0.01), The following table is the same.

3.3 The effect of different water and nitrogen treatments on the stem thickness of corn in each growth period

There are sieve tubes and ducts inside the plant stems, which are the main carriers for plants to transport nutrients and water. They have the function of maintaining plant stability, affecting the healthy development of plants, and also have the function of carrying out a small amount of photosynthesis and storing nutrients. Figure 3 shows the main effects of different water and nitrogen treatments on the dynamic changes of corn stem thickness. It can be seen that the change trend of corn stem thickness is the same. From the emergence of corn to the end of the jointing stage, the stem thickness changes greatly, and it grows rapidly at this stage. The stem thickness is basically stable at the beginning of the heading stage, and the corn enters reproductive growth . The main effect of the analysis of different irrigation amounts shows that the stem thickness of W3 treatment is the highest, which is 27.47 mm, which is 6.30%, 6.94% and 1.95% of W1, W2 and W4 treatments respectively. Based on the analysis of the main effects of different nitrogen treatments on the plant height of silage maize, N2 and N3 treatments significantly increased the stem thickness of silage maize, the highest stem thickness was 27.46 mm, which was 6.82% and 9.04% higher than that of N1 treatment, respectively.

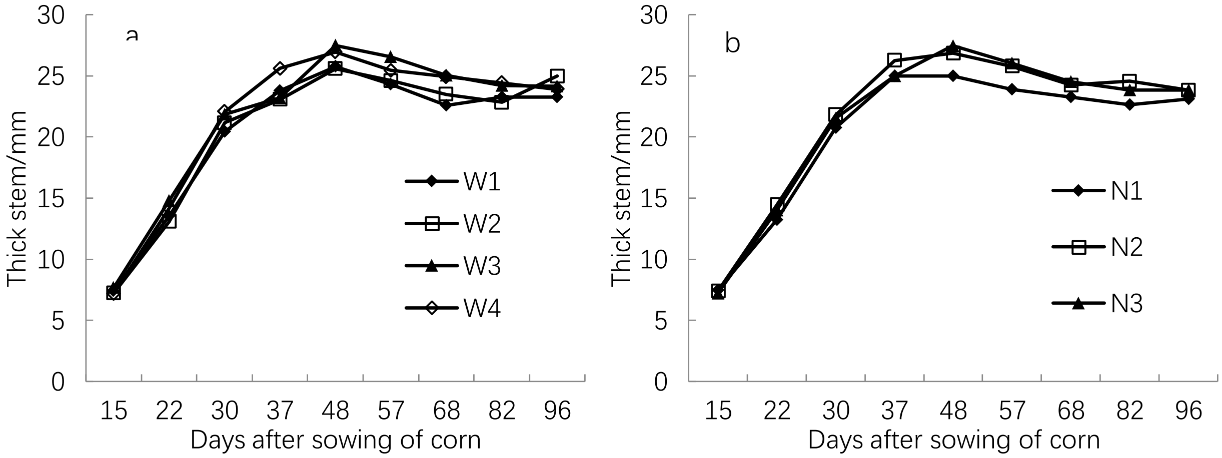

Figure 3. The main effects of different irrigation treatments and nitrogen treatments on the stalk thickness of corn

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Table 4 shows the effects of different water and nitrogen treatments on the stem thickness of corn at seedling stage, jointing stage, heading stage and filling stage. The best treatment for stem thickness at seedling stage and jointing stage was W3N3 treatment. The stem thickness was 16.64 mm and 29.96 mm, respectively, which were 6.01% and 11.72% larger than that of W4N2 (CK) treatment. The treatments with the largest stem thickness at heading and filling stage were W4N2 treatment, which were 26.23 mm and 26.27 mm, respectively, which were 5.26% and 7.08% higher than W4N1 treatment, and 9.76% and 14.05% higher than W4N3 treatment, indicating that excessive nitrogen was applied under sufficient irrigation. Suppresses the growth of stem thickness. The analysis shows that the seedling stage irrigation and nitrogen fertilizer treatments have no significant effect on the stem thickness of silage maize. Irrigation factors only have a very significant effect on the stem thickness at the heading stage. Nitrogen fertilizer factors have a significant impact on the stem thickness at the jointing and filling stages. The period has a very significant impact on nitrogen fertilizer factors, and the interaction between the two has a significant impact on the jointing and heading stages, indicating that irrigation and fertilization at the jointing and heading stages has an important impact on the growth of the stem.

Table 4. Effects of different water and nitrogen treatments on corn stem thickness

treatment		Seedling stage (cm)	Jointing period (cm)	Heading date (cm)	Grouting period (cm)
W1N1		13.99±1.72ab	23.45±0.4ab	21.62±1.69de	22.47±1.45a
W1N2		13.54±1.67ab	25.46±2.57ab	20.68±1.19e	23.94±1.64a
W1N3		13.1±1.25ab	28.32±4.89ab	25.48±0.48ab	23.4±2.71ab
W2N1		11.57±1.87b	22.85±1.29b	22.06±0.31cde	21.12±0.53ab
W2N2		14.58±0.55ab	26.79±1.44ab	24.81±1.23ab	23.46±1.47ab
W2N3		13.05±2.15ab	27.06±0.5ab	23.55±0.83bcd	23.89±0.65ab
W3N1		13.83±0.59ab	25.32±2.61ab	24.47±0.04abc	22.53±1.92ab
W3N2		13.96±0.96ab	27.15±0.82ab	25.27±0.62ab	24.55±1.06ab
W3N3		16.64±1.97a	29.96±3.35a	25.36±0.51ab	25.5±0.41ab
W4N1		13.53±0.72ab	28.29±1.08ab	24.85±0.37ab	24.41±1.51ab
W4N2		15.64±1.82ab	28.01±1.69ab	26.23±0.76a	26.27±1.66ab
W4N3		13.27±1.18ab	24.52±1.67ab	23.67±1.3abcd	22.58±0.92b
F value	W	2.36ns	1.53ns	15.23**	2.38ns
	N	2.06ns	4.01*	6.5**	5.27*
	W*N	2.39ns	2.93*	10.32**	2.17ns

3.4 Effects of different water and nitrogen treatments on dry and fresh weight, dry matter distribution and yield of corn

Table 5 shows the effects of different water and nitrogen treatments on the fresh weight and dry weight of corn at harvest. It can be seen that the fresh weight yield of silage maize varies within 64.49-88.7 t/hm2, and the dry weight yield varies from 10.4-30.32 t/hm2. The maximum fresh weight and dry weight are both treated with W4N2, which is higher than that of W4N1 and W4N3. The fresh weight yield was 10.94% and 37.01% higher, which was 9.63% and 25.10% higher than that of W4N1 and W4N3. Under the same irrigation treatment, with the increase of nitrogen application, the yield of silage maize increased first and then decreased. When the nitrogen application was N1 and N2, the yield increased with the increase of irrigation, and under high nitrogen (N3) treatment, the yield of silage maize increased. Yield first increased and then decreased with the amount of irrigation, indicating that suitable irrigation and fertilization can increase the dry and fresh weight of corn, but too high or too low nitrogen application will reduce the yield to a certain extent. The treatment with the highest corn grain yield was W4N2 treatment, and the highest yield was 9.84t/hm2, which was 7.42% and 14.23% higher than those of W4N1 and W4N3 treatments, respectively. Irrigation factors have a significant impact on the fresh weight of silage maize and the dry weight. Nitrogen fertilizer has a significant effect on the fresh weight and the dry weight. It shows that nitrogen fertilizer is the most important factor affecting the fresh weight of corn. Irrigation factors are the most important

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factors affecting the dry weight of corn. The interaction between the two has no significant effect on the fresh weight yield, but has a very significant effect on the dry weight yield. Nitrogen application has a significant impact on grain yield, and irrigation and the interaction of the two have a very significant impact on grain yield.

Table 5. Effects of different water and nitrogen treatments on dry and fresh weight, dry matter distribution and yield of corn

treatment		Dry matter fresh weight(t/hm2)	Dry matter dry weight(t/hm2)	Yield(t/hm2)
W1N1		64.49±8.36ab	17.11±2.13abcd	8.52±0.22cd
W1N2		66.62±5.87ab	19.24±1.96abc	7.82±0.12e
W1N3		59.06±21.23ab	10.4±3.06abc	7.81±0.13e
W2N1		68.87±10.59ab	18.2±2.51ab	8.35±0.19d
W2N2		75.98±3.18ab	24.43±1.04a	8.58±0.17cd
W2N3		66.44±3.88ab	19.78±2.32e	9.09±0.14b
W3N1		70.7±10.07ab	19.48±3.06de	9.13±0.04b
W3N2		84.98±14.46ab	18.79±3.23cde	8.86±0.1bc
W3N3		78.41±2.42ab	25.57±1.02cde	9.22±0.1b
W4N1		79±7.9ab	27.4±2.63bcd	9.11±0.1b
W4N2		88.7±5.63a	30.32±2.64bcd	9.84±0.1a
W4N3		55.87±11.83b	22.71±5.7bcd	8.44±0.16d
	W	3.437*	23.259**	116.142**
F value	N	5.84**	5.081*	3.919*
	W*N	1.678ns	5.724**	42.698**

Figure 4 shows the distribution ratio of dry matter stems, leaves and ears of corn. It can be seen that the organs account for the largest proportion of ears, followed by stems, and finally leaves. The treatments with the largest proportion of stems, leaves and ears were W3N3, W1N3 and W4N1 treatments. Under the W1 and W4 irrigation treatments, the nitrogen application rate increased and the dry matter stem ratio first increased and then decreased. Under the W2 irrigation treatment, the stem proportion also increased with the increase in the nitrogen application rate. Under the W3 irrigation treatment, the nitrogen application rate had an effect on the stems. The proportion of stalks has no significant effect. There was no significant change in the proportion of dry matter leaves under different treatments, indicating that irrigation and nitrogen application had no significant effect on leaf dry matter. Under the irrigation treatments W1, W2 and W3, the percentage of ears basically decreased with the increase of nitrogen application rate. Under the irrigation treatments W4, the dry matter of ears first decreased and then increased with the increase of nitrogen application rate, indicating that it increased under deficit irrigation. Nitrogen application rate will transfer more photosynthetic products to the stem.

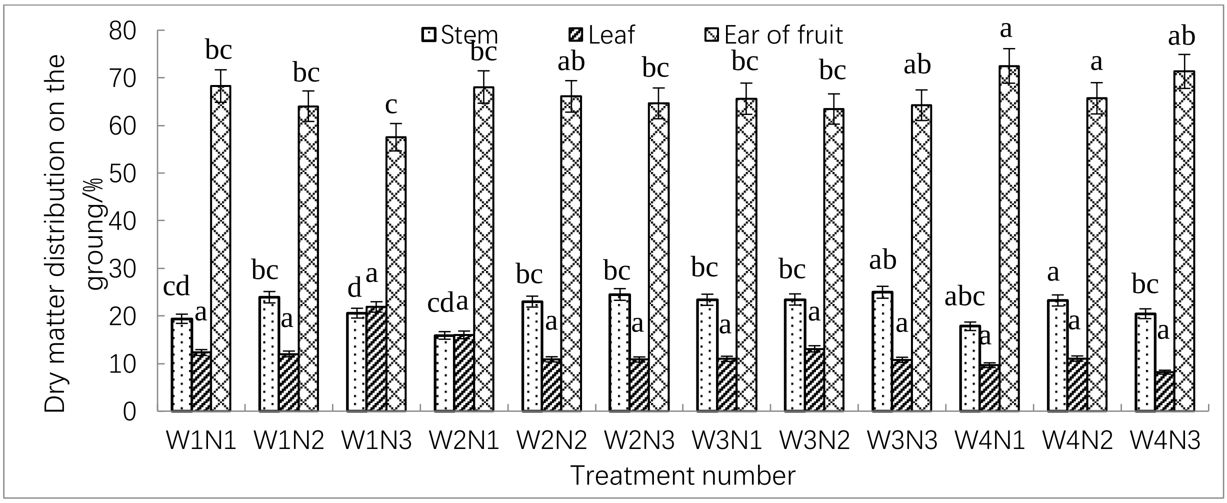

Figure 4. Distribution of dry matter in different organs of corn

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4. Conclusion and discussion

During the whole growth period of corn, the plant height changes showed a trend of rising first and then stable. The fastest growing period of plant height was the jointing stage. At harvest, the plant height of W2N2 treatment was the highest, which was 265.17 cm, which indicated that it was not that the larger the irrigation amount and the higher the fertilizer rate, the higher the plant growth. Deficit irrigation in the early stage and the appropriate nitrogen application rate are more conducive to the later plant height growth of corn . Nitrogen application is the main factor to increase plant height. From jointing stage to harvest, it has a very significant impact on plant height. Different irrigation treatments and the interaction between the two only have a significant impact on plant height at jointing stage. The stalk thickness of corn under different water and nitrogen treatments changed basically the same, and all showed a trend of first increasing and then decreasing. The jointing stage of silage maize is the period when the stem diameter increases the fastest, and the stem diameter begins to decrease at the heading stage. When corn was harvested, the W4N2 treatment had the largest stem thickness, which was significantly different from other treatments, which was basically consistent with the results of previous studies [8,13]. During the heading stage of silage maize, increasing the amount of irrigation water and a certain amount of nitrogen application can significantly increase the stem thickness of silage maize, and the interaction of water and nitrogen has a significant impact on the growth of the stem during this growth period. The maximum fresh weight and dry weight yield of silage maize were treated with W4N2. Under the same irrigation treatment, with the increase of nitrogen application, the yield of silage maize increased first and then decreased, indicating that suitable irrigation and fertilization can increase the dry and fresh weight of silage maize, but Too high or too low nitrogen application rate will reduce yield to a certain extent. The proportion of organ allocation in silage maize is ear>stem>leaf, which is consistent with Wang Ting’s research results [14]. Under W1 and W4 irrigation treatments, the proportion of dry matter and stalk first increased and then decreased with the increase of nitrogen application rate, W2 Under irrigation treatment, the proportion of stalks also increased with the increase of nitrogen application rate. Under irrigation treatment of W3, the amount of nitrogen application had no significant effect on the proportion of stalks. There was no significant change in the proportion of dry matter in leaves under different treatments, indicating that irrigation and nitrogen application had no significant effect on leaf dry matter. Under the irrigation treatments W1, W2 and W3, the percentage of ears basically decreased with the increase of nitrogen application rate. Under the irrigation treatments W4, the dry matter of ear ears first decreased and then increased with the increase of nitrogen application rate, indicating that it increased under deficit irrigation. Nitrogen application rate will transfer more photosynthetic products to the stem. Compared with W4 and W3 irrigation treatments, the percentage of ears in W2 and W1 treatments was significantly reduced, indicating that the yield reduction caused by water deficit reduced the yield of ears, which was similar to the results of Ning Dongfeng et al. [15].

In summary, the irrigation treatment of silage maize at the jointing stage is the key period that affects the growth of plant height. The irrigation treatment at the heading stage is the key period for increasing the stalk thickness of silage maize. The application of nitrogen fertilizer from the jointing stage to the filling stage will affect the corn plant. The growth of height and stem thickness, the interaction between the two has no significant effect on the plant height of corn during the whole growth period, but it has a significant impact on the growth of stem thickness from the jointing stage to the heading stage. The maximum grain yield was 9.84t/hm2, and the maximum fresh weight, dry weight and yield were all treated with W4N2.

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