 DOI: 10.19601/j.cnki.issn1943 - 9903.2018.1.012

Screening Test of Maize Varieties in Mountainous Arid Areas

Xiaojun GUO, Ping WANG, Chengjun XIE, Guoyu WANG*, Jianping HU, Long WEI

Lanzhou Agro-technical Science Research and Popularization Center, Lanzhou 730000, China

Abstract Drought and water shortage are the biggest limiting factors of dry farming, and variety plays an important role in an increase in the yield of dryland maize. Screening high-yield maize varieties is helpful to the continuous increase and stable yield of dryland grain. In this experiment, the growth period, characters and yield of 12 maize varieties were analyzed. The results show that the yield of Ganyu series was low, while the yield of Lianda 169 was the highest (8 080.93 kg/ha), which was 31.40% higher than Jinsui 4. The yield of Dunyu 16 was 6 621.06 kg/ha, 7.64% higher than Jinsui 4. The two varieties had good comprehensive characters, so they could be popularized and planted in dry farming areas of Lanzhou City.

Key words Drought, Maize varieties, Yield, Variety test

1 Introduction

In Lanzhou City, the total area of cultivated land is 0.21 million ha, of which the area of mountainous dry land is 0.131 3 million ha, accounting for 63% of the total area of cultivated land. Drought is the most serious natural disaster in Lanzhou and the most important natural disaster that has a direct impact on agricultural production. To develop dry farming and to cultivate new growth points is an important measure to develop agriculture in arid areas and is needed for the increase of peasants' income. In recent years, the production of dry farming in Lanzhou City, has made great strides. The dry farming technology of maize with film mulching technology as the center has been widely popularized and applied, and the planting area of maize accounts for 15.2% of the total planting area of crops all year round and is always more than 33 300 ha for five consecutive years[1]. The stable development of grain production has effectively promoted the increase of peasants' income.

Under the conditions of rain-fed dry farming, the high and stable yield of maize mainly depends on the tolerance of varieties to water deficit[2], so it is very important to choose appropriate maize drought-resistant varieties to increase the yield of maize[3]. In this study, under the conditions of rain-fed dry farming, the growth period, yield and population characteristics of different maize varieties were compared to select suitable high-yield maize varieties for dry farming areas.

2 Materials and methods

2.1 General situation of the test area Mengjiashan Village is located in the arid mountainous area of southeastern Yuzhong, with the average elevation of 2 400 m, the annual average temperature of 7.4℃, the annual average precipitation of 350 mm, the annual evaporation of 1 450 mm, the annual frost-free period of 150 d, and the annual sunshine duration of 2 500 h. Here precipitation from July to September accounts for 56% of annual precipitation. In 2016, high temperature in April appeared earlier than that in the same period in an average year; from July to September, average temperature was about 1.3℃ higher, and precipitation was over 20% less than that in the same period in an average year. In this year, precipitation is small, and drought lasts for a long time. The experimental area is a typical semi-dry loess hilly region, and the test soil is loessal soil.

2.2 Test varieties There were 12 maize varieties in the experiment, including Xianyu 335, Baodan 3, Lianda 169, Jindan 73, Ganyu 804, Ganyu 812, Ganyu 816, Ganyu 810, Ganyu 803, Ganyu 811, and Dunyu 16. Local cultivar Jinsui 4 was as the control.

2.3 Test methods Randomized block arrangement was adopted, and there were three repetitions. The area of each plot was 35.2 m^2 (8.0 m × 4.4 m). Seeds of the maize varieties were sown in trenches on two ridges and were covered by plastic mulch. Before the seeds were sown, farmyard manure (45 000 kg/ha), urea (150 kg/ha) and ordinary superphosphate (750 kg/ha) were applied, and the planting density was 49 500 plants/ha. Soil preparation and mulching were conducted on November 1, 2015, and sowing was carried out on April 9, 2016. At the jointing stage, urea (300 kg/ha) was applied again. Other management measures were taken like fields. The growth period of maize was recorded. In the mature period, 10 maize plants were collected from each plot to calculate yield.

3 Results and analysis

3.1 Growth period Seen from Table 1, all maize varieties sprouted 30 - 35 d after sowing. The growth period of the maize varieties was 115 - 135 d. Among these maize varieties, the growth period of Ganyu series of maize varieties was between 115 and 119 d, and these maize varieties became mature early due to drought. The growth period of Xianyu 335, Lianda 169

Received: October 15, 2017 Accepted: January 5, 2018
Supported by Planning Project of Lanzhou Science and Technology Bureau (2015-3-60).
* Corresponding author. E-mail: 114557337@qq.com

and Dunyu 16 was more than 130 d, so they are medium and late maturing varieties, and their growth period was 8 d longer than that of Jinsui 4 at least.

Table 1 Comparison of growth period of maize varieties

Variety	Sowing date	Seeding date	Bell date	Tasseling date	Maturation date	Growth period//d
Xianyu 335	04 – 09	05 – 10	06 – 25	07 – 10	09 – 23	135
Baodan 3	04 – 09	05 – 12	05 – 25	07 – 10	09 – 15	125
Lianda 169	04 – 09	05 – 14	07 – 07	07 – 18	09 – 25	137
Jindan 73	04 – 09	05 – 10	06 – 22	07 – 10	09 – 12	125
Ganyu 804	04 – 09	05 – 13	06 – 22	07 – 05	09 – 06	115
Ganyu 812	04 – 09	05 – 09	06 – 22	07 – 05	09 – 04	117
Ganyu 816	04 – 09	05 – 09	06 – 22	07 – 05	09 – 04	119
Ganyu 810	04 – 09	05 – 09	06 – 22	07 – 05	09 – 04	117
Ganyu 803	04 – 09	05 – 09	06 – 22	07 – 05	09 – 04	117
Ganyu 811	04 – 09	05 – 09	06 – 22	07 – 05	09 – 06	119
Jinsui 4 (CK)	04 – 09	05 – 10	06 – 28	07 – 10	09 – 15	127
Dunyu 16	04 – 09	05 – 12	07 – 12	07 – 22	09 – 25	135

3.2 Main characters According to Table 2, the plant height of these maize varieties was between 1.71 and 2.23 m, of which Xianyu 335 was the highest (2.23 m), 0.09 m higher than Jinsui 4. The plant height of early maturing varieties such as Ganyu 816, Ganyu 810, Ganyu 803 and Ganyu 811 was smaller than 1.90 m, and they were shorter than CK. The ear position height of these maize varieties ranged from 47.33 to 98.87 cm, of which Dunyu 16 had the maximum ear position height, followed by Jinsui 4, while Lianda 169 had the minimum ear position height. Among these maize varieties, the row number per ear of Lianda 169 was the largest, followed by Xianyu 335, and the the row number per ear of Jinsui 4 was 16. Lianda 169 had the largest grain number per row, followed by Dunyu 16. The grain number per row of Ganyu series was between 34 and 40, 4 – 8 smaller than Jinsui 4. The ear diameter of Xianyu 335, Lianda 169, Jinsui 4, and Dunyu 16 was larger than 4 cm, of which Xianyu 335 had the largest ear diameter. The ears of Jinsui 4 was the longest, followed by Dunyu 16. In a word, the ear diameter, ear length, row number per ear, and grain number per row of Ganyu series were relatively small, while these characters of Xianyu 335, Lianda 169, Jinsui 4, and Dunyu 16 were relatively large.

Table 2 Main characters of the maize varieties

Variety	Plant height//m	Ear position height//cm	Row number per ear	Grain number per row	Ear diameter//cm	Ear length//cm
Xianyu 335	2.23	69.75	17.0	39.0	4.65	18.38
Baodan 3	1.71	47.33	13.6	38.4	3.54	18.88
Lianda 169	2.02	49.60	18.0	44.8	4.29	19.48
Jindan 73	1.91	56.60	15.0	39.5	3.45	19.18
Ganyu 804	2.13	75.33	16.0	38.0	3.88	18.50
Ganyu 812	2.01	74.33	13.8	40.4	3.65	18.54
Ganyu 816	1.88	58.84	12.4	37.2	3.54	16.76
Ganyu 810	1.79	58.46	14.8	34.2	3.52	17.72
Ganyu 803	1.78	72.31	13.6	33.2	3.22	16.81
Ganyu 811	1.76	66.34	13.8	34.6	3.42	17.15
Jinsui 4 (CK)	2.14	85.23	16.0	43.3	4.27	22.67
Dunyu 16	2.21	98.87	16.8	44.2	4.31	20.14

3.3 Yield and yield composition The grain weight per ear of the maize varieties was 100.23 – 218.56 g, of which Dunyu 16 had the largest grain weight per ear (218.56 g), 15.52 g larger than Jinsui 4 (Table 3). The cob weight of Jinsui 4 was the highest, up to 45.76 g, while the minimum of cob weight was only 20.14 g. The hundred-grain weight of the maize varieties was between 23.24 and 34.22 g, and the hundred-grain weight of Dunyu 16 was 34.22 g, 2.64% higher than that of Jinsui 4. The double ear rate of Lianda 169 was the highest, reaching 60%, followed by Jindan 73. Each plant of Xianyu 335, Jinsui 4, Dunyu 16, Ganyu 812, Ganyu 816 and Ganyu 803 had only an ear. The yield of the maize varieties was between 3 036.37 and 8 080.93 kg/ha, of which the yield of Lianda 169 was the highest, followed by Dunyu 16, 31.40% and 7.64% higher than that of Jinsui 4 respectively. The yield of other maize varieties was lower than that of Jinsui 4, of which Ganyu 803 had the lowest yield. The yield of Lianda 169 and Dunyu 16 was high, so they could be popularized, while Xianyu 335 and Jindan 73 need to be studied through an experiment.

Table 3 Yield and yield composition of the maize varieties

Variety	Grain weight per ear // g	Cob weight // g	Hundred-grain weight // g	Double ear rate // %	Yield kg/ha	Changing rate of yield // %	Order
Xianyu 335	160.15	33.14	26.99	0	4 851.58 c	-21.12	5
Baodan 3	139.91	27.72	27.73	10	4 662.28 c	-24.20	7
Lianda 169	187.35	34.64	25.47	60	8 080.93 a	31.40	1
Jindan 73	160.15	22.56	23.65	20	5 821.90 bc	-5.35	4
Ganyu 804	142.25	27.79	26.20	10	4 740.25 c	-22.93	6
Ganyu 812	120.75	20.29	26.11	0	3 658.00 d	-40.53	10
Ganyu 816	113.87	21.40	26.82	0	3 449.58 d	-43.92	11
Ganyu 810	122.12	23.16	23.24	0	3 699.50 d	-39.85	9
Ganyu 803	100.23	20.14	24.12	0	3 036.37 e	-50.64	12
Ganyu 811	121.32	21.34	23.46	5	3 859.03 d	-37.26	8
Jinsui 4 (CK)	203.04	45.76	33.34	0	6 150.89 b	0.00	3
Dunyu 16	218.56	44.38	34.22	0	6 621.06 b	7.64	2

4 Conclusions

The growth period, characters and yield of the 12 maize varieties were analyzed. The results showed that the growth period of the maize varieties was 115 - 137 d. The yield of Lianda 169 and Dunyu 16 was 31.40% and 7.64% higher than that of Jinsui 4 respectively. Their plant height and ear position were appropriate, and their grain number per ear was large, while their hundred-grain weight was large, so they could be popularized and planted in dry farming areas of Lanzhou City. The yield of Ganyu series as early maturing varieties was low, so they should not be popularized. Xianyu 335 and Jindan 73 need to be studied through an experiment.

References

[1] LI JL, HE JH, LIU XL, *et al.* The main diseases and insect pest control technology of dry corn in Lanzhou City[J]. Gansu Agricultural Science and Technology, 2015(1): 88 - 89. (in Chinese).

[2] LV S, YANG XG, ZHAO J, *et al.* Effects of climate change and variety alternative on potential yield of spring maize in Northeast China[J]. Transactions of the Chinese Society of Agricultural Engineering, 2013, 29(18): 179 - 190. (in Chinese).

[3] MA ZY, DING GJ, ZHANG Q, *et al.* Studies on yield and population characters of different maize varieties in rain-fed areas [J]. Crops, 2010(5): 39 - 42. (in Chinese).

(From page 39)

4.2.1 Examination and approval and certification regulations on the establishment of agriculture-related enterprises. Countries along the "Belt and Road" impose provisions on the examination and approval authorities, approval procedure, and certification for foreign capitals setting up wholly-funded agricultural enterprises or agricultural joint venture. Russia stipulates that any agricultural enterprise with a share of foreign capitals may not participate in the agricultural field restricted by the state and must be approved by the state agricultural department in advance. Such approval includes the planning and operation of funds and expenses, and also includes approval of workers and management staff. Hungary stipulates that the license of foreign capitals participating in agricultural enterprises must be obtained from local or central agricultural bureau.

4.2.2 Examination and approval of shares and proportion of foreign capitals buying from domestic agricultural enterprises. These restrictions mainly relate to whether foreign capital can buy the shares of the agriculture-related enterprises in the host country, the proportion of purchase shares, the competent authorities for approval, the application and procedure for examination and approval, the contents of examination and approval and the reference objects[7]. Slovenia stipulates that any foreign acquisition of Slovenian agricultural enterprises more than 10% of the total share must be evaluated by the government for review, and the contents of review mainly include market condition, domestic status and influence of the enterprise, potential influence of introduced foreign capitals, and benefits and losses for domestic agricultural enterprises; Turkey stipulates that foreign capitals can buy shares of domestic agriculture-related enterprises, but they must comply with laws related to investment in securities and foreign investments, and shall obtain authorization of general administration of foreign investment.

References

[1] YAO MZ. International investment law[M]. Wuhan: Wuhan University Press, 2011: 185. (in Chinese).

[2] KONG SH. International investment[M]. Beijing: University of International Business and Economics Press, 2010: 152. (in Chinese).

[3] MAHJOOBI E, SARANG A, ARDESTANI M. Management of unregulated agricultural nonpoint sources through water quality trading market[J]. Water Science & Technology, 2016, 74(9): 21 - 62.

[4] BONANOMI EB. Sustainable development in international law making and trade: International food governance and trade in agriculture[J]. Trade and Environment, 2015, 46(3): 185 - 209.

[5] BANHEGYI G. Global challenges and new approaches in the common agricultural policy 2014 - 2020[J]. Eu Agrarian Law, 2015, 3(2): 48 - 54.

[6] DISDIER A, FONTAGNE L, MIMOUNI M. The impact of regulations on agricultural trade: Evidence from the SPS and TBT agreements [J]. American Journal of Agricultural Economics Appendices, 2014, 90(2): 336 - 350.

[7] JOSLING TE, TANGERMANN S, JOSLING TE, *et al.* Transatlantic food and agricultural trade policy: 50 years of conflict and convergence [J]. American Journal of Agricultural Economics, 2016, 98(3): 102.