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Key Points of Simple Cultivation Technique for Whole-plant Silage Maize in Guangxi

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Abstract With the vigorous development of animal husbandry in Guangxi, feed problems have become increasingly prominent. Silage maize has the characteristics of rapid growth, high nutritional value, easy digestion and absorption, and a large amount of biological output being obtained in a short time. It is one of the ideal basic feeds for cattle and sheep and other breeding industries. Based on this, the simple cultivation technique of whole-plant silage maize was summarized from the aspects of land preparation, selection of maize variety, sowing, field management, pest control and timely harvesting, so as to provide technical reference for scientific planting of silage maize in Guangxi.

Key words Whole-plant silage maize, Cultivation technique, Guangxi Zhuang Autonomous Region

1 Introduction

Whole-plant maize silage was made of green maize plants including ears harvested during late milk ripe stage to early waxy ripe stage. It is used as feed for herbivorous livestock after being chopped and fermented[1]. Silage maize has the characteristics of tall height, strong stalk, high biomass yield, high starch content, high dry matter content, good fiber quality, good green retention, high digestibility and good palatability[2]. Silage maize is an important organic part of the forage industry. The development of the silage maize industry is an important means to promote the sustainable development of modern animal husbandry in China, and is an important driving force for responding to national planning, adapting to market demand, promoting rural economic development, and improving rural ecological environment[3]. The development of silage maize is an effective measure to develop herbivorous livestock such as dairy cows, beef cattle, and mutton sheep, and can effectively alleviate the problem of human and animal competition for food[4].

At present, Guangxi is vigorously developing animal husbandry, and the number of livestock such as cattle and sheep is increasing day by day. It provides a good opportunity for the development of whole-plant silage maize[5]. According to the survey statistics, in 2017, Guangxi's cattle and sheep population in stock was 4.2627 million and 2.0814 million heads, respectively. When the annual silage demand of one cattle or 10 sheep is assigned as 667 m^2 and the proportion of maize silage in the diet is 50%, 149 000 ha of silage maize is required to be planted. In accordance with the requirements of the "grain to forage" policies [*Notice of the Department of Agriculture and Rural Affairs of Guangxi Zhuang Autonomous Region on Doing a Good Job in Reserves for the "Grain to Forage" Projects in 2019* (Gui Nong Ye Fa [2018] No.49) and *Notice of Department of Agriculture and Rural Affairs of Guangxi Zhuang Autonomous Region on Issuing the Tasks of "Grain to Forage" in 2019* (Gui Nong Ting Fa [2019] No.9)] implemented by the Guangxi Department of Agriculture and Rural Affairs, the sown area of silage maize in Guangxi will continue to increase. The planting technology of whole-plant silage maize is different from that of ordinary fodder maize. Whole-plant silage maize has higher requirements for planting technology. In order to solve the technical problems encountered in silage maize planting, the simple cultivation technique of whole-plant silage maize is summarized in this article from the aspects of site preparation, seed selection and treatment, timely sowing, scientific field management, pest control, and timely harvest, thereby providing technical reference for scientific cultivation of silage maize in Guangxi.

2 Land selection and preparation

Plots with level land, medium soil fertility, good water and fertility retention, high terrain and good drainage should be selected. Before land preparation, rocks, weeds and plastic bags should be removed. When preparing the land, intensive cultivation is required, which is the key to high yield of silage maize. Land preparation should meet the six-character requirements of uniformity, leveling, looseness, brokenness, cleanness and moisture[6].

3 Variety selection

Maize varieties officially approved by China or Guangxi covering the area should be selected. Maize seeds should be purchased from regular seed companies or business outlets, and invoices should be requested and properly kept. Currently, Guangxi has no officially approved special-purpose silage maize varieties. Therefore, when selecting maize varieties, on the one hand, spe-

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cial silage maize varieties that contain more tropical and subtropical germplasm or the special silage maize varieties approved by neighboring provinces can be introduced, and silage maize varieties with northern temperate germplasm can also be introduced carefully. Otherwise, greater losses may be caused due to unsuitability. On the other hand, common fodder maize varieties that are suitable for local planting with large biological yield, good green retention, good disease resistance and strong adaptability can be selected as silage maize according to the local ecological environment. According to relevant test results, the varieties suitable for being used as silage maize in Guangxi include Guidan 162, Guidan 166, Zhengda 808, Huayou 168, Kenfeng 808, Guidan 901 and Qingqing 921.

4 Sowing

4.1 Sowing in time After the ground temperature stabilizes at 8 – 10 ℃, sowing can be carried out when the soil moisture is sufficient. The recommended sowing time for maize in Guangxi is as follows. (i) Spring maize is recommended to be sown from late January to mid-February in southern Guangxi, from early to late February in middle Guangxi, and from early to middle March in northern Guangxi and alpine mountainous area. (ii) Autumn maize is recommended to be sown from mid-June to mid-July, and no later than the end of July. (iii) In coastal areas, sowing of winter maize should be done before the end of October, and in other places, it should be before October, 15. Guangxi belongs to the subtropical monsoon climate zone and the tropical monsoon climate, with a complex ecological environment. Therefore, in different regions, in addition to the above-mentioned sowing time, factors such as the specificity of the region and market demand should be considered comprehensively.

4.2 Applying seed fertilizer Seed fertilizer should be applied before sowing, in the form of drill fertilization or hole fertilization. For drill fertilization, ditches, with a depth of 10 cm, should be dug. The distance between adjacent ditches is 65 cm. Fertilizer is applied to the inner side of the ditches. It should be careful not to let the seeds come into direct contact with the fertilizer. For hole application, holes (65 cm in length and 23 cm in width) are dug directly, and the depth of the holes is about 8 cm. The distance between fertilizer and pre-sown seeds is 3 – 5 cm. The application rate of seed fertilizer is as follows: 45 – 60 kg/ha of urea, 60 – 75 kg/ha of phosphate fertilizer and 60 – 75 kg/ha of potassium fertilizer; or 150 kg/ha of compound fertilizer ($N:P_2O_5:KCl = 15:15:15$).

4.3 Sowing method It is generally recommended to use a single-row single-plant method for sowing. This can balance the light and moisture of each maize plant as much as possible. In the case of lack of labor, a single-row double-plant or double-row single-plant sowing method can also be considered.

4.4 Planting at a reasonable density Reasonable dense planting is an effective way to increase the yield of silage maize. The planting density of silage maize is higher than that of ordinary feed maize. Generally, 67 500 maize plants are sown per hectare. At the same time, different planting densities should be adopted according to soil fertility and variety. In general, for fertile soil and compact maize varieties, the planting density can be increased appropriately; and if the fertility of soil is general and maize varieties are of flat type, the planting density should be reduced appropriately. However, even in the case of dense planting, the planting density should not exceed 75 000 plants/ha, otherwise, it is easy to cause lodging; and for low-density planting, it is recommended to plant no less than 60 000 plants/ha, otherwise, the yield advantage of silage maize cannot be maximized.

5 Field management

5.1 Seedling thinning and final singling Seedlings need nutrients and light. In order to avoid competition, when the silage maize seedlings start to grow a certain number of leaves, they need to be thinned[2]. When the maize grows to 3 – 4 leaves, thinning and final singling should be carried out. Weak, small, diseased and miscellaneous seedlings are removed, and as a result, strong, uniform and pure seedlings are retained (1 – 2 seedlings/hole). When the maize grows 5 – 6 leaves, final singling is carried out. Excess seedlings are removed. If seedlings are insufficient, they are replenished to ensure that each hole has one robust seedling. For plots with a heavier occurrence of underground pests and more seedling shortages, final singling can be delayed 1 – 2 leaf age according to the situation.

5.2 Topdressing and intertillage The yield-increasing effect of fertilization on maize depends on the level of soil fertility, variety characteristics, ecological environment, fertilizer types and fertilization techniques. After the maize has grown 4 – 5 leaves, it is necessary to use a micro tillage machine or a cattle worker to cultivate the soil in time, accompanied by topdressing, and the fertilizer should not be in direct contact with the plants. The conduction of topdressing is mainly to loosen the soil and remove weeds. Generally, 2 – 3 times of topdressing and inter-tillage are carried out according to the maize production situation after final singling. Topdressing can be divided into seedling fertilizer, jointing fertilizer and ear fertilizer. The seedling fertilizer is applied at the age of 4 – 5 leaves (75 kg of urea and 90 kg of potassium chloride per hectare), jointing fertilizer is applied at the age of 8 – 9 leaves (225 kg/ha of urea and 225 kg/ha of potassium chloride), and ear fertilizer is applied at the age of 12 – 13 leaves (375 – 450 kg/ha of compound fertilizer).

5.3 Drought and waterlogging prevention In Guangxi, spring maize often encounters spring drought after sowing, while there is often more rain after sowing of summer maize, prone to waterlogging. Watering and loosening soil should be carried out timely to ensure moisture in case of drought; and drainage should be carried out in time when waterlogging occurs, and the soil should be loosened in time after drainage to prevent soil compaction.

6 Disease and pest control

The control of plant diseases and insect pests should be

strengthened. Focusing on prevention, relevant measures should be taken promptly once diseases and pests are discovered. The main pests and diseases faced by silage maize in Guangxi include sheath blight, leaf blight, cutworm, *etc.* (i) Sheath blight: Generally, it is easy to occur when the moisture in the field is high, so field dehumidification is required. If it happens in the early stage, the lower part of the diseased leaves can be stripped to prevent the virus from spreading. Also, 5% jinggangmycin aqueous solution or 40% dimethachlon wettable powder can be spayed for prevention and treatment. (ii) Leaf blight. In the early stage of the disease, 10% difenoconazole water dispersible granules (1 000-fold diluted), propiconazole 25% EC (2 000-fold diluted), or 80% mancozeb wettable powder (500-fold diluted) can be sprayed for control. (iii) Cutworm. The insecticidal lamp can be used to trap and kill the adults. Also, the bait such as wheat bran (60 – 75 kg/ha) can be sauteed, added with 2 250 mL of 90% trichlorfon aqueous solution (30 – fold diluted) and sprinkled on the ground in the evening. Or, the injured plants in the affected plot are found and dug out manually in the morning to kill the larvae.

7 Timely harvesting

The timely harvest of silage maize will greatly affect its yield and quality, very important for the cultivation of silage maize[7]. If silage maize is harvested too early, its biological yield will be affected; if it is harvested too late, its nutritional value will decline, and its quality is poor. Therefore, in general, maize is harvested from milk ripe stage to waxy ripe stage when the nutrient content is relatively high. Maize can be harvested when the following phenomena appear: (i) the milk line of maize grains reaches 1/3 – 2/3; (ii) 30 – 40 d after the maize silks; (iii) maize grains are easy to be scratched with nails but there is no obvious water leakage. When harvesting, attention should be paid to the control of height of stubbles. Too high stubbles will affect the yield of silage; while too low stubbles will be easier to entrain soil, and in turn, the pathogens in the soil will affect the storage of silage maize. Generally, the whole plant is mowed at 10 – 15 cm above the ground.

8 Conclusions

The simple cultivation technology of whole-plant silage maize in Guangxi is analyzed and studied. It can reasonably regulate the planting method and avoid reducing the yield of silage maize due to mistakes in planting technology, thereby improving the economic benefits of silage maize. In practice, silage maize must be managed strictly in accordance with the technical requirements of silage maize cultivation, and special attention should be paid to the control of key technical links such as planting density, water and fertilizer management, and timely harvesting, so as to provide scientific support for the improvement of the yield and quality of whole-plant silage maize in Guangxi.

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