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Research Progress on the Quality of Explosive Corn

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Abstract: Burst corn is a special type of corn specially used for making corn flower series snack food. Because there are few germplasm resources in burst maize, the breeding level and efficiency are restricted. At present, the yield of burst corn is low, the burst quality is not ideal, and the good germplasm resources are poor, which limits the development and utilization of burst corn. Burst quality is the key of burst corn commodity value. The improvement of burst corn must increase yield on the premise of ensuring good burst quality. This paper collected dozens of burst corn materials from home and abroad, and measured their burst quality, in order to screen out the excellent burst corn; At the same time, the hybridization and backcrossing offspring of burst maize and common maize, as well as the burst quality of burst maize's self-crossing offspring were determined in order to provide the basis for the breeding of burst maize varieties. The results showed that there were great differences in bursting quality among different bursting maize, such as yellow bursting l, stone bursting 2, Shanghai P2, Shanghai P4, 932, TP34, TP51, TP52, TP55 and red bursting 1, which had higher bursting rate and larger swelling multiples, reaching 99.7%, 97.7%, 98.8%, 97.6,97.4%, 98.6,97.3%, 98.3% and 97.6%, respectively. Ordinary maize was hybridized with burst maize, and then the latter was used to cross back to the first generation. In the S1 and S2 generation of burst corn, the burst quality changed little, and the decline was not obvious.

1. Introduction

Burst corn is one of the nine main types of corn, specially used for processing to produce popcorn. At present, the yield of burst corn is low, the burst quality is not ideal, and the good germplasm resources are poor, which limits the development and utilization of burst corn. Burst quality is the key of burst corn commodity value. The improvement of burst corn must increase yield on the premise of ensuring good burst quality. Plants appear to be multi-branched, multi-panicle, spikelets, seeds with apical process, the skins of different colors are hard and translucent. The endosperm accounts for four-fifths of the weight of the seed, which is 90% starch

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and about 10% protein, embedded in the protein-based mesh. About 75% of the starch is keratinized, which is distributed in the periphery of the grain, while about 25% of the starch is silty, which is embedded in the middle of the grain by keratinized starch. Burst corn has been cultivated in China for more than 400 years. Burst corn has been planted sporadically in different corn producing areas, but it is mostly cultivated by farmers. In the early 1980s, China imported exploded corn and processing machines from the United States through Hong Kong hallik company, with annual imports reaching thousands of tons. Since then, through more than 10 years of improvement, development and utilization of China's scientific research workers, as well as introduction and improvement of foreign excellent burst maize varieties, has been bred for China's cultivation of burst maize new varieties. Shanghai, hubei, sichuan, xinjiang, shanxi, shandong, Beijing and the northeast region, burst corn production has formed a certain scale, the end of China's import burst corn history, the national production and processing enterprises have reached dozens of, processing, sales and other serial commodity development has been rapidly developed

Corn flowers are nutritious. Nutritionally, it provides 67 percent of the protein in beef, 110 percent of the iron and the same amount of calcium [1]. Fifty grams of burst corn provides the energy equivalent of two eggs [2]. The skins are also excellent whole grains, rich in fiber and other polysaccharides, comparable to the skin of a drum or whole wheat toast [3]. Corn flowers promote the digestion and absorption of food. Take in a certain amount of exploding jade flowers every day, can sharpen the stomach wall, increase gastrointestinal peristalsis, thus promoting the digestion and absorption of food. Can exercise the masseter muscle and can clean the teeth. Eat often burst jade flower, undertake "powerful chew", can exercise masseter muscle, make facial skin becomes smooth and handsome. At the same time, the corn flower keeps rubbing with the teeth, which can clean the teeth [4]. Burst corn is easy to process and does not need complicated technology and equipment. In ordinary residential households, as long as there are exploded corn and domestic corn exploder (if there is no exploder, it can also be replaced by an iron pot), corn exploder can be exploded anytime and anywhere [5], which is incomparable to ordinary corn. Popcorn is delicious. Bursting corn, with its mellow and crisp taste, is an excellent leisure food. Popcorn, but also according to the preferences of consumers, add appropriate seasonings to flavor. In addition, the processing form of exploded corn flower is the one with the least loss of raw grain nutrients in all corn processing products [6]. In recent years, with the improvement of people's living standard and food structure in China, burst corn has had a certain consumer market, the market is gradually expanding, it is of certain practical significance to study the popcorn with burst quality.

In recent years, popcorn has become a delicious and convenient health food all over the world. The burst quality of burst corn was studied earlier in USA, Australia and Canada. The most prominent characteristic of burst corn is that it can expand rapidly when it encounters high temperature under normal pressure, and finally burst into corn flower [7]. Bursting quality includes: explosion rate, expansion multiple, crispness, suitability, fragrance, appearance shape, etc. For example, LIU believes that the bursting property of burst corn is a quantitative trait under the combined action of multiple genes and environmental factors, and the heritability of h2 is greater than 0.7[8]. Schnitkey Gary believes that there is no direct relationship between production and expansion multiple [9], while SU believes that there is a negative correlation between production and expansion multiple [10]. ZHANG believes that bursting is restricted by the relative ratio of cutin endosperm [11], and that the peel ACTS as a pressure vessel. The crispness is positively correlated with the expansion factor. The best bursting property was found when the water content of the grain was 14%. The most suitable temperature is 190~195℃. So far, it is generally believed burst in the middle of the corn grain is the burst cause of opaque endosperm contains more water, when it is heated evaporation, and peripheral corn starch gelatinization, become tough and elastic colloid, and the density of the skin, form a closed pressurizer, when the internal vapor pressure

reaches a certain extent, the grain suddenly forced to unwind, grain is burst into flower [12, 13]. Burst corn has a history of several hundred years in China, but the research on burst corn started late. In the early 1980s, China mainly imported burst corn from the United States, with an annual import of thousands of tons, and imported processing machinery. Since then, through the efforts of scientific research workers for more than ten years in China, at the same time pay attention to the introduction, improvement and utilization of the foreign good burst of maize varieties, which is suitable for planting in China has bred burst corn varieties, such as the Chinese academy of agricultural sciences' crops of the golden flower, Shanghai academy of Shanghai no. 1, 2, shenyang agricultural university, shen 1, 2, 3, henan agricultural university, and no. 2 and no. 3, jilin ji l, 2, 3, shanxi's to 1, the rock burst of xinjiang into 806 l and sichuan, etc. [14], some varieties have been mass production. In Shanghai, hubei, sichuan, xinjiang, shanxi, shandong, Beijing and northeast China, explosive corn production has reached a certain scale, ending the history of explosive corn import in China. Blowout of the national corn has reached dozens of series products production and processing enterprises, burst corn industry got rapid development. At present our country small and medium-sized cities have burst corn products, microwave special product production is the comprehensive implementation of the localization, the growing market of sales, to burst of corn of popcorn as a leisure food more and more be favorred, consumption increased year by year [15].

This paper collected dozens of burst corn materials from home and abroad, and measured their burst quality, in order to screen out the excellent burst corn; At the same time, the hybridization and backcrossing offspring of burst maize and common maize, as well as the burst quality of burst maize's self-crossing offspring were determined in order to provide the basis for the breeding of burst maize varieties. The results showed that the bursting quality of different bursting maize was different from each other, and the bursting quality of yellow bursting maize, stone bursting maize 2, Shanghai P2, Shanghai P4, 932, TP34, TP51, TP52, TP55 and red bursting maize 1 had higher bursting rate and larger swelling ratio, which was good bursting maize. Ordinary maize was hybridized with burst maize, and then the latter was used to cross back to the first generation. In the S1 and S2 generation of burst corn, the burst quality changed little, and the decline was not obvious.

2. Proposed Method

2.1. Selection and Breeding of Burst Corn

The breeding procedure of burst maize is basically the same as that of ordinary maize, with the only difference being that the selected inbred lines and hybrids should have higher burst performance, that is, yield and resistance should be increased on the basis of high burst rate and burst multiple [16].

(1) Self-Crossing Breeding

According to statistics from the institute of commodity management, Chinese academy of agricultural sciences, there are about 100 local varieties of burst corn registered in China, and some scientific research institutions in Shanghai, shenyang, xinjiang and other places have selected a number of excellent inbred lines and arranged hybrid seeds, which have been applied in production [17]. The quality of burst maize from different sources is very different, and some excellent inbred lines can be screened out from improved varieties and local varieties. The United States has earlier studies in this field, and the selected varieties have better comprehensive traits, especially higher swelling multiples, so such hybrids or improved population can be used to select lines [18].

(2) Backcross Transfer

A new burst maize line can be obtained by backcrossing the inbred line with the burst maize line and the inbred line with the excellent hard grain or horse tooth type, taking the burst maize line as the recurrent parent, and by backcrossing and self-crossing for 2-3 generations [19]. The obtained

new lines had the same explosion expansion multiples as or better than the original burst maize lines, and the yield and lodging resistance were improved, and the agronomic characters were also improved [20].

(3) Samsara Selection

First widely collect burst corn resources at home and abroad, after a blowout, lodging resistance identification, quality measurement and output to select good varieties of grain equal mix, in the isolation zone free pollination, synthetic based group, then the group is improved by the recurrent selection method [21], make excellent plant random mating, scatter in good genes of different plants fully reorganization, forming a new improved group, after several rounds of improved group burst quality and agronomic traits, yield can be improved. The existing varieties in China are not ideal in terms of quality, yield, lodging resistance and plant type, which should be mainly selected by recurrent selection at the beginning of breeding [22].

2.2. Criteria for Evaluation of Burst Quality of Burst Corn

It is generally believed that the reason for the bursting of burst corn is that the silty endosperm in the center of the grain contains more water, which evaporates and expands when heated, and when the internal vapor pressure reaches a certain level [23], the grain is forced to explain suddenly, the pressure drops sharply, and the expansion of the grain is exploded into corn flower. There are many factors that affect the bursting quality of bursting maize. The results of these studies are similar or consistent, while others are different or inconsistent, due to different materials and human factors. It is worth mentioning that most of these studies focus on the internal factors of burst corn and less on the external factors. For the burst quality of burst corn, there is still a lack of objective quantitative standards. The bursting quality of a variety is generally judged from the following aspects [24-25].

(1) Grain

The thousand kernel weight is an important index for the breeding and processing of burst corn, which has a certain correlation with unit yield and burst quality. The smaller the thousand kernel weight of burst corn, the better its burst quality [26]. However, the smaller the 1000-grain weight is, the lower the general yield will be. Therefore, the coordination between 1000-grain weight and yield is also an important topic in breeding [27].

(2) The Rate of Popcorn

Detonation rate refers to the percentage of grains that can burst in a batch of corn: detonation number/test detonation number ×100%. Different varieties of bursting maize have different bursting rates, and the higher the bursting rate, the better the bursting quality.

(3) Expansion Multiple

The expansion multiple is the reciprocal of the volume ratio before and after the bursting of maize, that is, the volume after the bursting/the volume before the bursting ×100%. Expansion multiple is an important indicator to reflect burst quality. The larger the expansion multiple, the better the burst quality. The expansion multiple of burst corn of different varieties is different .

(4) Single Flower Volume

Single flower volume refers to the volume of a batch of corn burst after the ratio of burst grain number, it reflects the size of corn burst single flower burst.

(5) Spend Time

The bursting time of burst corn refers to the length of the period from the beginning of burst to the end of burst. The shorter the burst time, the stronger the consistency, the better the burst quality.

(6) Flower Shape

The flower shape after burst corn burst with different burst varieties and varied, but good burst corn burst flower shape should be mushroom or butterfly.

(7) Color and Fragrance

The color, fragrance and taste of popcorn after blasting are the direct reflection of its commercial value. Good popcorn should be white powder or white milk, without shell, tender, crisp and delicious.

2.3. Factors Affecting Burst Quality

The burst quality of burst corn is not only related to varieties, but also affected by many factors, such as peel, starch composition, moisture content and processing temperature .

(1) The Skin

The peel is an important factor influencing the burst quality. As mentioned above, the existence of the peel is equivalent to the role of a sealing pressurizer. Once the peel is broken or peeled off, the effect of this sealing will be weakened or lost, and the bursting performance of corn will be greatly affected. With the increase of the area and degree of peel treatment, its burst quality gradually declined. This indicates that the peel ACTS as a pressure vessel before bursting. The more the peel is damaged or peeled, the lower the vapor pressure inside the kernel, the smaller the expansion multiple of the kernel and the lower the bursting rate.

(2) Cutin Endosperm and Silty Endosperm

The ratio of keratin starch in burst corn is generally higher than that in other types of corn. Through the anatomy of the tested varieties, it was found that the keratinized starch and silty starch of different varieties of bursting maize had very different distribution positions in the grain, and the bursting maize was divided into four types, namely embryo type, endosperm type, separated type and combined type.

Embryotype characterized by the silty endosperm enclosed in a very thin layer above the embryo.

Endosperm type: The main characteristic is that the powdered endosperm is embedded in the horny milk, occupying less space and proportion.

Seperate: The silty endosperm is divided into two parts, one adjacent to the embryo and the other surrounded by the horny endosperm, forming two separate parts. This type has the characteristics of both types, so it is called the detached type.

United type: Its main characteristic is that the powdered endosperm extends from the periphery of the embryo to the middle of the endosperm, forming a union, occupying a larger proportion and space, called united type.

Most of the varieties with better burst quality had combined endosperm, followed by separate endosperm. The main reason for the difference of bursting maize varieties is the difference of grain structure. Under the premise that the outer end of the grain has good sealing property, only the combination type structure can form the uniform and sufficient internal pressure of the grain. Therefore, the combined silty endosperm can be used as an important index in the breeding of burst corn quality.

(3) Water Content Burst

The bursting of maize is based on the rational understanding that the internal water vaporization of maize results in the increase of seed internal pressure after heating, but the water content is not arbitrary. The moisture content suitable for blasting is 10~14%. The effect of water content on expansion multiple is realized by single flower volume. When the water content is in the optimal range, the expansion multiple is the largest, the volume of single flower is the largest, and the color, fragrance and palatability are the best.

(4) Detonation Temperature

The explosivity of burst corn includes explosivity, expansion multiple, explosivity shape,

softness, fragrance and color. The temperature of detonation has a great influence on the bursting property, which directly affects the quality of detonation. The experiment shows that the optimum temperature is 190~195℃. Low temperature low burst rate single flower small; When the temperature is high, the burst rate is high.

(5) The Maturity

Maturity not only affects the yield of corn but also affects the quality of raw materials. The ground is loose, explode flower rate is low, grain floret is small, and color and fragrance are bad also. When maturity is insufficient, endosperm fullness is poor, quality maturity also affects the appearance quality of raw corn. Low maturity maize has dim color, poor glossiness, flat grains, large and abundant shell, long crown with increased crown.

(6) Other Factors

The moth, damage, germination and even wear of burst corn will affect the effect of burst, which brings corresponding requirements to the storage and transportation of raw materials. Excessive sun exposure will make the endosperm dry crack, grain fade, resulting in flower fragmentation and color deterioration. The shape of grain affects the shape of flower, the round grain is the best, the flat grain and the long grain are not ideal. Different processing methods, processes and processing equipment different detonation effect and expansion times are different.

3. Experiments

3.1. Basic Materials for Test

The test material was 52 pieces of burst corn collected from home and abroad. Its source is 14 in the province, 15 at home, 23 abroad. Provincial burst corn for local varieties; Domestic burst maize includes local varieties, hybrids, improved populations and self-crossing high-generation materials; One of the overseas burst corn was American burst and the rest was Thai burst corn, which was isolated from TIP~TP55 improved population.

3.2. Determination Method of Burst Quality

(1) The Field Asks for Planting

The above 52 pieces of burst corn were planted in the field, each material was 3-4 rows, the line length was 6m, and the planting density was 57,000 plants /ha. Self-pollination or mixed pollination occurred during flowering and powder dispersal. Two well-developed ears were taken after maturity, and the bursting quality was determined after seed moisture content reached 14% or so.

(2) Determination of Burst Quality

50g of each material was taken to measure the pre-detonation volume, and then placed in an ak-800 corn exploder to explode at 220℃, count the number of burst grains and the number of unburst grains, and measure the post-detonation volume. The percentage of the number of burst grains and the number of total grains is the bursting rate, and the ratio of the volume after explosion to the volume before explosion is the expansion multiple. Repeat 4 times for each material and calculate the average value.

(3) Burst Quality of Hybrid and Backcross Offspring

The bursting rate and expansion ratio of inbred lines,Fl and BCI were determined by using bursting maize bursting 1 of the high self-crossing generation as the parent of bursting maize, crossing with four ordinary maize inbred lines, such as Kl, 035-6, 77-1 and ta 22C, etc.

(4) Burst Quality of Self-Delivered Offspring

The best burst quality plant (S0) was selected from the burst maize to produce S1 and S2 generation, and the burst rate and expansion multiple of S0, S1 and S2 generation were determined.

4. Discussion

4.1. Analysis of Burst Quality of Different Burst Maize

Most of the 52 burst maize were of pearl type, with very few rice grain type. Only spiny corn, TP31, TP35, TP36 and TP51 were of rice grain type. This may have to do with the rice grain type hard to threshing, easy to be eliminated. The color of seeds is mainly yellow, followed by white, and there are more red seeds and purple seeds in guizhou.

(1) Analysis of Bursting Rate of Maize

As shown in Figure 1, the 52 burst maize varieties showed great differences, with 99.7% of yellow burst 1 as the highest and 15.2% as the lowest. More than 95% had 19, accounting for 36.5%; There were 13 from 90% to 95%, accounting for 25.0%; There were 4 from 85% to 90%, accounting for 7.8%; There were 6 in 80%~85%, accounting for 11.5%; 75%~80% had 3, accounting for 5.8%; Seven were less than 75%, accounting for 13.4%. It can be seen that 61.5% and 67.3% of burst corn with explosive rate greater than 90% accounted for more than 85%. TP31, TP34, TP52, TP55, yellow burst 1, red burst 1, stone burst 1, stone burst 2, Shanghai corpse 2, Shanghai P4, 913, 932 and so on have higher burst rate. In TP burst maize, the difference in burst rate is also large,TP31, TP52 up to 98.3%, and TP35 is only 54.0%, guizhou burst maize burst rate is medium, most 80%~90 write, a few have a high burst rate, such as red burst 1 up to 96.0%. Some of them look like burst corn from the seed, but the plant is tall after planting, and the seed becomes larger, and it is no longer burst corn, indicating that natural hybridization has occurred with ordinary corn, and its burst rate is very low, such as J white burst is only 15.2%.

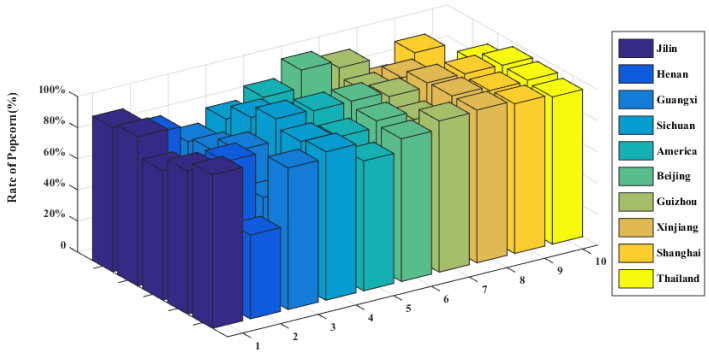

Figure 1. Bursting quality of bursting corn: bursting rate

(2) Expansion Multiple Analysis of Burst Corn

In terms of expansion times, as shown in Figure 2, the difference between 52 burst maize is also large, with 28.3 times of shidaobu 2 being the largest, and 1.7 times of J white burst being the smallest. More than 25 times are yellow burst 1, white burst 2, stone burst 2, Shanghai P2, TP34, TP51, TP55, 7, accounting for 13.5%; 22 times 20~25, accounting for 42.3%; There were 8 15-20 times, accounting for 15.4%; 8 of 10~15 times, accounting for 15.4%; Seven were less than 10 times, or 13.5%. As a result,55.8% of burst corn is 20 times larger. 71.2% of burst corn is 15 times more. In these burst corn, artificially modified materials generally have higher expansion multiples, such as yellow burst l(26.7), white burst 2(25.5), stone burst (28.3), Shanghai P2(26.8), Shanghai P4(25.2), 932(24.8). Most local varieties have low expansion ratios, such as rice and corn (16.8), pingshan exploder (17.4) and longli exploder (10), while only a few are higher, such as red exploder l(24.0) and spiny corn (21.2). In TP burst maize, the difference of expansion multiples was also large, which was larger in TP22(23.5), TP31(22.8), TP34(26 2), TP51(27.4), TP55(25.5), and smaller in TP12(11.9), TP35(6.2).

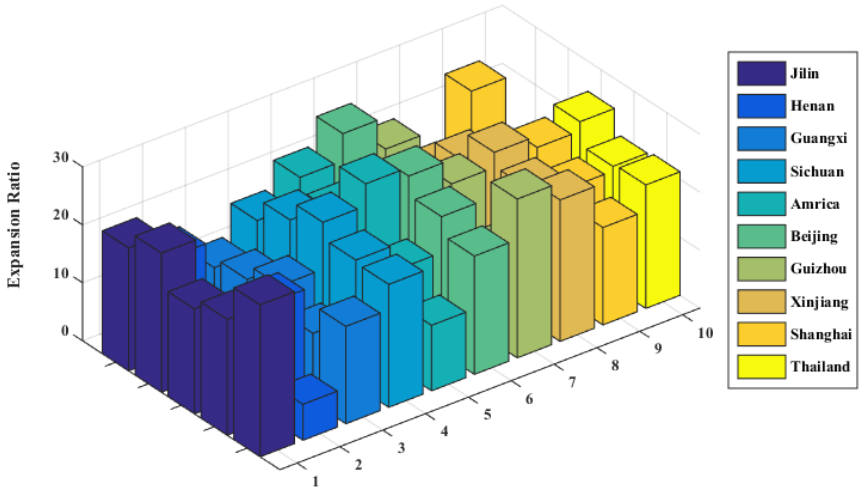

Figure 2. Burst quality of burst corn: expansion multiple

Bursting rate and expansion multiple are important indexes to measure bursting quality, although there is a high correlation between them, but in the quality of measuring bursting corn should be considered, because sometimes although the bursting rate is high, but exploded rice flower is small, expansion multiple is not high. For example, the bursting rate of TP36 is 91.1% and the expansion multiple is only 16.8. On the contrary, some burst corn explosion rate is not very high, but burst of rice flower, expansion multiple is larger. For example, the detonation rate of white burst 2 is 92.8%, similar to that of TP36, and its expansion multiple is 25.5 times. Good burst corn should have a high burst rate and a large expansion multiple, the former should be more than 95%, the latter should be more than 20 times. Yellow burst 2, stone burst 2, Shanghai P2, Shanghai P4, Q32, TP34, Tp51, Tp52, Tp55, red burst 1 are burst quality burst corn.

4.2. Analysis of Burst Quality of Hybrid and Backcross Offspring

As can be seen from Table 1, the explosivity and expansion multiples of the 22C4 inbred lines of Kl, 77-1, 035-6 and ta were all very low, with little difference. The burst quality of F1 produced by hybridization between burst maize and them was between burst maize and inbred line, but different combinations had different results. 77-l× yellow burst 1 was the lowest, with detonation rate and expansion multiples of 19.5% and 1.9 times, respectively. Tower 22C× yellow burst 1 is the largest, with explosion rate and expansion multiple reaching 84.5% and 11.8 times respectively. In the backcross generation, most of the plants had higher burst quality than F1 and showed the characteristics of separation. In the four combinations, the grain morphology of each individual plant was similar to that of burst corn, which had the special color of burst corn, but the burst quality was quite different. The optimal single plant of Kl× yellow burst IBCI reached 98.4%, and the expansion multiple was 25.6, which was close to that of yellow burst l. The optimal flowering rate of BC1 of 77-l× yellow burst 1 and tower 22C× yellow burst 1 was 96.9% and 98.8%, which were close to that of yellow burst 1. The expansion multiples were 20.4 and 21.6 times, which were different from that of yellow burst 1, indicating that the improvement of detonation rate was faster than that of expansion multiples. The performance of 035-6× yellow burst IBC1 was poor, and the optimal plant burst rate and expansion multiple were 70.0% and 10.8 times, respectively. It can be seen that the nuclear background of inbred lines has a certain effect on the improvement of burst quality. Other traits of the single plant with the best bursting quality were also improved. The optimal single plant of Kl× yellow bursting 1BC1 had better panicle length (18cm), row number (18), panicle grain number (496), grain weight (69.7g) and resistance capacity than yellow bursting

1. It can be seen that it is feasible to use ordinary corn to improve burst corn.

Table 1. Crack quality of F1 and BC1 generation

Combination		Rate of Popcorn	Expansion Ratio
K_1		0.0	1.5
K_1 ×Yellow pop1		63.5	8.2
(K_1 ×Yellow pop1) ×Yellow pop1	-1	60.8	6.0
	-2	98.0	25.6
035-6		1.2	1.8
035-6 ×Yellow pop1		41.2	3.6
(035-6 ×Yellow pop1) ×Yellow pop1	-1	50.8	8.6
	-2	70.0	10.8
77-1		3.2	1.8
77-1 ×Yellow pop1		19.5	1.9
(77-1 ×Yellow pop1) ×Yellow pop1	-1	48.2	7.8
	-2	96.9	20.4
Ta22C		4.2	2.1
Ta22C ×Yellow pop1		84.5	11.8
(Ta22C ×Yellow pop1) ×Yellow pop1	-1	59.1	6.1
	-2	98.8	21.6

4.3. Analysis of Burst Quality of Self-Delivered Offspring

It can be seen from Figure 3 and Figure 4 that, from S0 to S2, the self-confessed explosion rate and expansion times of most burst maize do not change much, and plants with good S0 burst quality have good burst quality of their offspring. Shanghai P2, Shanghai P4, shi shou 1 and huang shou 1 had higher detonation rates and expansion multiples, and their S1 and S2 also had higher detonation rates and expansion multiples. S0 burst quality is poor burst maize, its offspring burst quality is also poor. The detonation rate and expansion multiple of white burst 1S0 were 79.1% and 14.8 times respectively, while the detonation rate and expansion multiple of S1 and S2 were both lower. The bursting rate and expansion multiple of 913S0 were larger, but the bursting quality of S1 and S2 was decreased to some extent.

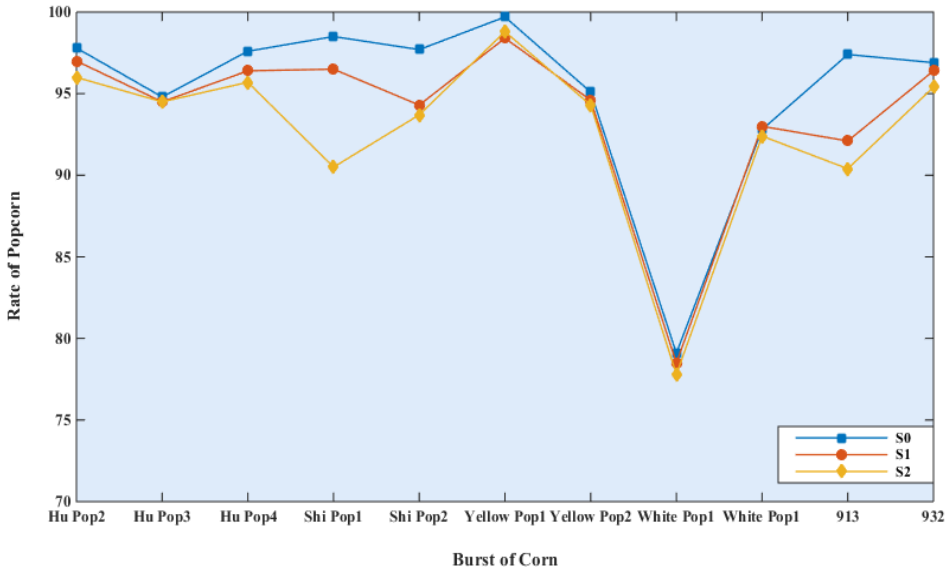

Figure 3. Bursting quality of Self-delivered offspring: bursting rate

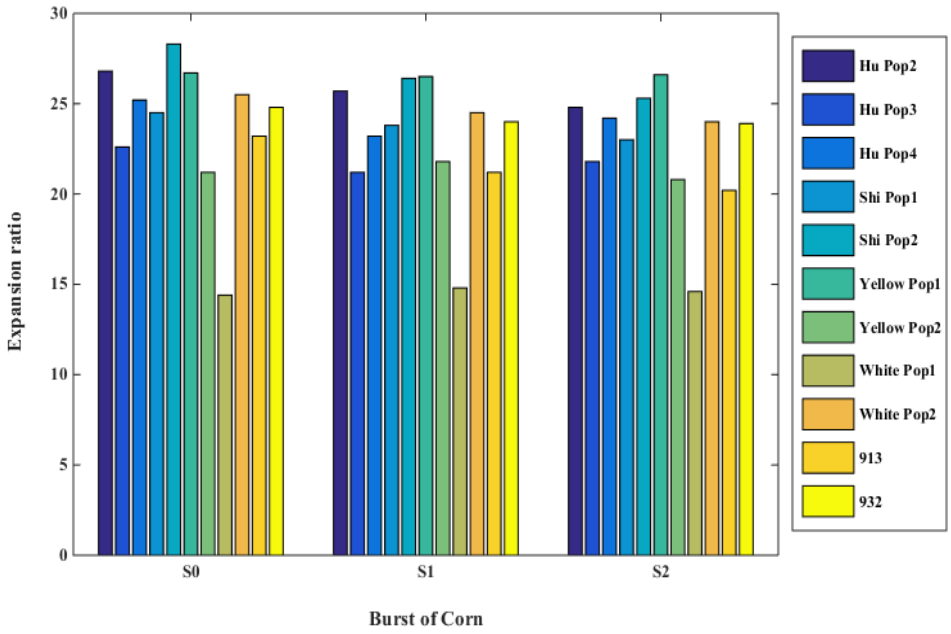

Figure 4. Bursting quality of Self-delivered offspring: expansion ratio

From the analysis of 52 burst maize, it is found that the quality of different burst maize is quite different, and some excellent materials can be screened out from improved varieties and local varieties. Due to the sporadic distribution of burst maize, most of the local varieties have natural hybridization with ordinary maize to varying degrees, leading to the decline of burst quality, but the growth potential and adaptability are strong. Improved varieties after some improvement, most of the burst quality is better, but introduced from the origin of the local, some characters become bad. For example, the introduction of materials from xinjiang, jilin and Beijing into guizhou shorted the growth period, insufficient nutrient growth and low yield. Therefore, it is necessary to analyze as many materials as possible in the improvement of burst maize varieties, to screen out better materials as parents, and to combine burst quality with agronomy. Since the relationship between burst quality and seed morphology is not obvious, and affected by other varieties of serial powder, the determination of burst quality should be self-cross or mixed pollination for each burst corn. Burst maize is short in general, with poor lodging resistance and low yield, so it should be improved. In the improvement of burst maize, ordinary maize can be used as the parent, using the way of backcrossing and selection.

5. Conclusion

The popcorn produced by excellent burst corn is big, good color, crisp and fragrant, which is a nutritious and easy to digest leisure food. However, most of the existing burst corn has a low yield, burst quality is not ideal enough, and excellent germplasm resources are poor, which limits the development and utilization of burst corn. Burst quality is the key of burst corn commodity value. The improvement of burst corn must increase yield on the premise of ensuring good burst quality. As for the processing products of burst corn, they are basically used to explode corn flower. Therefore, the difference of its burst quality determines the quality of the product. Although the bursting quality of a variety is its intrinsic factor, it still has practical significance in guiding the processing of products. It is generally believed that the reason for the bursting of burst corn is that the silty endosperm in the center of its powder grains contains more water, which evaporates and

expands in case of heat. When the internal vapor pressure reaches a certain level, the grains are forced to explain suddenly, the pressure drops sharply, and the expansion of the grains is exploded into corn flowers. There are many factors influencing the burst quality of burst corn. The results of these studies are similar or consistent, while others are different or inconsistent, due to different materials and human factors. It is worth mentioning that the internal factors of burst corn seldom involve the influence of external factors. For the burst quality of burst corn, there is still a lack of objective quantitative standards.

The common indexes to measure the quality of bursting corn are bursting rate and bursting multiple. Detonation rate refers to the percentage of the number of explosives-exploded corn kernels in a certain temperature range after heating. Bulk-burst ratio refers to the ratio of the volume of popcorn after bulk-burst to the weight or volume of the tested kernel. The breeding target of burst corn should be combined with its use, and the demand of market consumers and producers should be considered. From the consumer point of view, a good burst corn varieties to have a higher burst rate, generally more than 95%; Explosion expansion multiple to be large, generally more than 25 times, after explosion flowers to be large, white fluffy, less entrance slag, good palatability. From the producer side, burst maize requirements agronomic character is good, suitable growth period, lodging resistance is strong, pests and diseases have strong resistance, at the same time to have a higher yield, generally in 200kg/666.7m2 above. The breeding procedure of burst maize is basically the same as that of ordinary maize, except that the selected inbred lines and hybrids should have higher burst performance, that is, the yield and resistance should be increased on the basis of high burst rate and burst multiple.

From the results of this study, it can be seen that after hybridization of common maize and burst maize, the burst quality of individual plants has been restored to the level close to that of burst maize, and the agronomic traits have been improved. From the perspective of nuclear composition, BC: there is still a certain genetic composition of common maize, which has potential for improvement. In increasing yield, because the grain weight is negatively correlated with burst quality, multi-grain inbred lines can be used as parents. It can be seen from the little change of burst quality in the offspring of self-crossing that burst quality has higher heritability, can be used to select the inbred line with excellent burst quality by continuous self-crossing.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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