

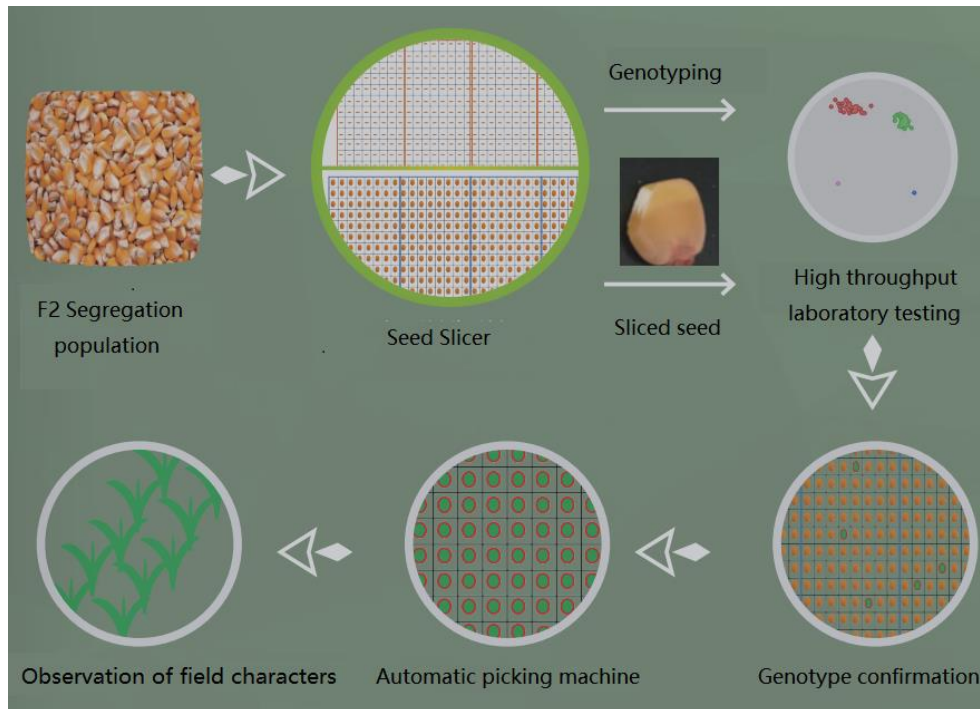
SUMMARY OF SEED SLICER

Significance of seed slicer:

In the process of crop molecular marker-assisted breeding, it is necessary to detect the prospect and background of a large number of seeds, and then select the seeds that meet the breeding objectives. Traditionally, artificial slicing is used for a large number of seed selection, but there are some problems, such as long time, low efficiency, poor sampling quality and so on. With the expansion of the scale of molecular breeding in China, seed slice sampling has become the bottleneck of high-throughput molecular breeding technology.

Through painstaking research and development, following the development of a minimally invasive sampling system for maize seeds with independent intellectual property rights in 2017, the research progress was accelerated in 2018. A fully automated, batch and productive platform for minimally invasive sampling of rice and wheat seeds has been developed, which provides a more comprehensive solution for the development of molecular marker-assisted breeding technology in China.

Application flow of slicer :



Application of automatic maize seed minimally invasive system in high-throughput molecular-assisted breeding

Application field of slicer:

Molecular marker-assisted selection breeding is a new breeding technique which has developed rapidly in the world in the past two decades. It makes use of the close linkage between molecular markers and target character genes to screen individuals with target character from the breeding population. It can effectively reduce the number of breeding individuals, shorten the breeding cycle, and fundamentally solve the problems of inaccurate identification, high cost and long cycle in traditional breeding.

With the development of molecular detection technology and the expansion of breeding scale, population sampling has become the bottleneck of molecular marker-assisted selection breeding. Field leaf sampling is inefficient and error-prone. And more than 80% of the breeding populations planted in the field are discarded at the seedling stage, resulting in a serious waste of breeding resources. Before sowing, the seed slicing technique is used to sample the seeds, and the genetic information of the seeds can be obtained by analyzing the samples. It is only necessary to plant the seeds of the desired genotypes in the field, which greatly reduces the population planting scale.

With the combination of automatic seed slicing technology and high-throughput molecular detection technology, a new breeding model has been formed, which can select the best one from tens of thousands of seeds to participate in breeding, improving the breeding efficiency and scale exponentially.

HIGH THROUGHPUT CORN SEED SLICER



Function and Performance:

1. Efficiency: Fully automatic slicing, high speed. Measured efficiency is 17min per disk. At least 4000 seed slices can be sampled every day, and more than 8000-10000 slices can be sampled by high-end commercial machines.
2. Cross-contamination: There will be no cross-contamination between different seed cutting.
3. Slice size: the target tissue sample range obtained by cutting is between 15mg-40mg, meeting the use of 50 markers, and the user can automatically adjust the setting.
4. Collection: The tissue samples and the remaining materials were separately packed into different 96-well plates, and 100% of them corresponded one to one.
5. Information storage: The corresponding sample information and location information of two pairs of samples can be automatically exported, and the archived files can automatically form a tree folder structure in the form of daily, monthly, quarterly and annual forms for tracking and query.
6. Germination rate: The cutting position of the seed is far from the embryo and will not damage the seed vigor, which is completely suitable for field germination testing. The subsequent germination rate compared with the control seedling rate is more than 95%.

Seedling test data after slicing:

Material	Treatment	Germination rate	P 值	Seedling rate	P 值
PH4CV	Slicer	99%	0.378	96%	0.397
	CK	97%		94%	
PH4CV	Slicer	98%	0.0706	96%	0.456
	CK	95%		95%	
DIKA516 SS	Slicer	94%	0.311	97%	0.305

Table 1: Statistics of germination rate and seedling rate of germination plate

HIGH THROUGHPUT RICE / WHEAT SEED SLICER



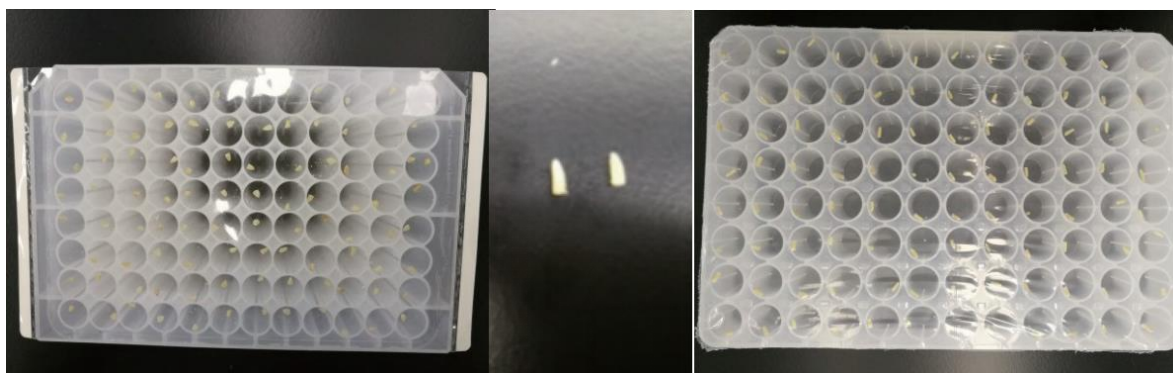
Function and Performance:

- 1、Efficiency: Fully automatic slicing, high speed. At least 5000 seed slices can be sampled every day (8H), and more than 8000-10000 slices can be sampled by high-end commercial machines.
- 2、Cross-contamination: There will be no cross-contamination between different seed cutting.
- 3、Slice size: The target tissue sample obtained by cutting does not exceed 1/2 of the total length of the sample, which can be automatically adjusted by the user.
- 4、Collection: The tissue samples and the remaining materials were separately packed into different 96-well plates, and 100% of them corresponded one to one.
- 5、Information storage: The corresponding sample information and location information of two pairs of samples can be automatically exported, and the archived files can automatically form a tree folder structure in the form of daily, monthly, quarterly and annual forms for tracking and query.
- 6、Germination rate: The cutting position of the seed is far from the embryo and will not damage the seed vigor, which is completely suitable for field germination testing. The subsequent germination rate compared with the control seedling rate is more than 95%.

Experimental data of rice seed slicing:

NUMBER	CGMBR203	CGMBR504	CGMBR603
TKW(g)	16.79	21.55	19.87
Slice success rate	93.50%	95.7%	92.50%
Emergence rate of section group	92%	96%	94.00%
CK	98%	99%	98.00%

Effect and collection of slices and seeds after slicing:



HIGH THROUGHPUT AUTOMATIC PICKING MACHINE



Function and Performance:

1. A high-throughput seed selector integrating corn, rice/wheat seed selection.
2. Programs/files/formats are compatible with other systems, and compatible programs are customizable.
3. 100% selection success rate.
4. Selection efficiency: an average of 1 seed per 4s, that is, 15 seeds per minute, 900 seeds per hour
5. If there is an error in the selection process, the equipment will give an automatic sound and light alarm.

Application case:

The use of seed slicing technology to detect seeds requires strict correspondence between the

position of DNA samples and seeds. Through the selection machine, the corresponding seeds can be selected quickly and accurately according to the selection results of DNA samples for re-numbering and sorting. The programmed operation can basically avoid the selection errors caused by human factors. The uninterrupted operation of the machine can complete the selection and sorting of all the seeds sliced by the slicer in one day.