



Basic Principle and Technique System of Crop Breeding

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Abstract

In this paper, firstly, basic contradiction between suitable ability and yielding-ability of a variety was revealed through abstracting and generalizing a large phenomenon in tests and productions of crops. The basic contradiction and its movement decided yield display of a variety. Yield-ability (or yield potential) of a variety was yield under the most suitable condition for the variety. But in practice the variety had been often planted under relatively unfavorable environment. It had adaptability for conditions. Secondly, nature, action and significance of ecological traits were determined. Comparison tests using of similar isolines of glowing period and pod bearing habit in soybean in multiple years discovered that varieties having suitable ecotype could fuller display its yield ability and gave better yield stability in much years Thirdly, all of yield ability traits and reciprocal relationships among these yield ability traits were determined, mainly on basis of research accomplishments of crop physiology, using axiom method to set up complete theory system of yield ability and net system of trait components. The net system of all traits of seed yield display, basic principle of engineering of crop breeding had been determined, and it revealed both reciprocity among all of ecological traits and yield ability traits of a variety and forming mechanism of seed yield performance. Technique system of crop breeding engineering and suggestions on personnel organization system and division (coordination) in a new type of crop institute were proposed on the basis of basic principle.

Keywords

Basic Principle, Technique System, Crop Breeding

Subject Areas: Agricultural Science

1. Basic Principle of Crop Breeding

1.1. Basic Principle Explaining through Diagrams: Net System of All of Genetic Characteristics of Yield Stability and Yield Ability of Crops

The net system both deciding reciprocity among over hundred characteristics and forming mechanism of seed

yield performance had been determined through research in thirty one years (Figure 1). This was basic principle of engineering of crop breeding [1] [2].

1.2. Basic Method and Main Process Setting up the Net System

Firstly, analyzing and researching basic contradiction of yield performance of a variety, the expression formula was raised. Yield performance was decided by contradiction between adaptability and yield ability, environment playing role through the contradiction [1] (Figure 2).

The yield ability (or yield potential) of a variety yielded under the most suitable condition for the variety. But in practice, a variety often had been planted in relatively unfavorable environment, and it had adaptability for the environment. The formula was important advance for formula of “Phenotype = Genotype + Environment” that had been continued in more than one hundred and fifty years, and it revealed internal contradiction of yield performance of a genotype. The formula of basic contradiction laid groundwork to differentiate the two different types of characteristics and set up the net system including all of ecological traits and yield ability traits. This was also a reason of no setting up the basic principle of crop breeding, even though crop breeding had already history in more than one hundred and fifty years.

Secondly, nature, action and significance of ecological traits were determined. Comparison tests using of similar isolines of glowing period and pod bearing habit in soybean in multiple years discovered that varieties having suitable ecotype could fuller display its yield ability and gave better yield stability in much years [3] [4], and unsuitable ecology characteristics (such as excessively early or late mature period) had obviously negative influence on else ecological traits and all of yield ability traits. After this, leaf size [5], resistance to lodging [6], root system type [7], resistance to diseases and pests, all kinds of physiological resistance [2] [8] etc. were determined to belong to ecology-adaptability characteristic.

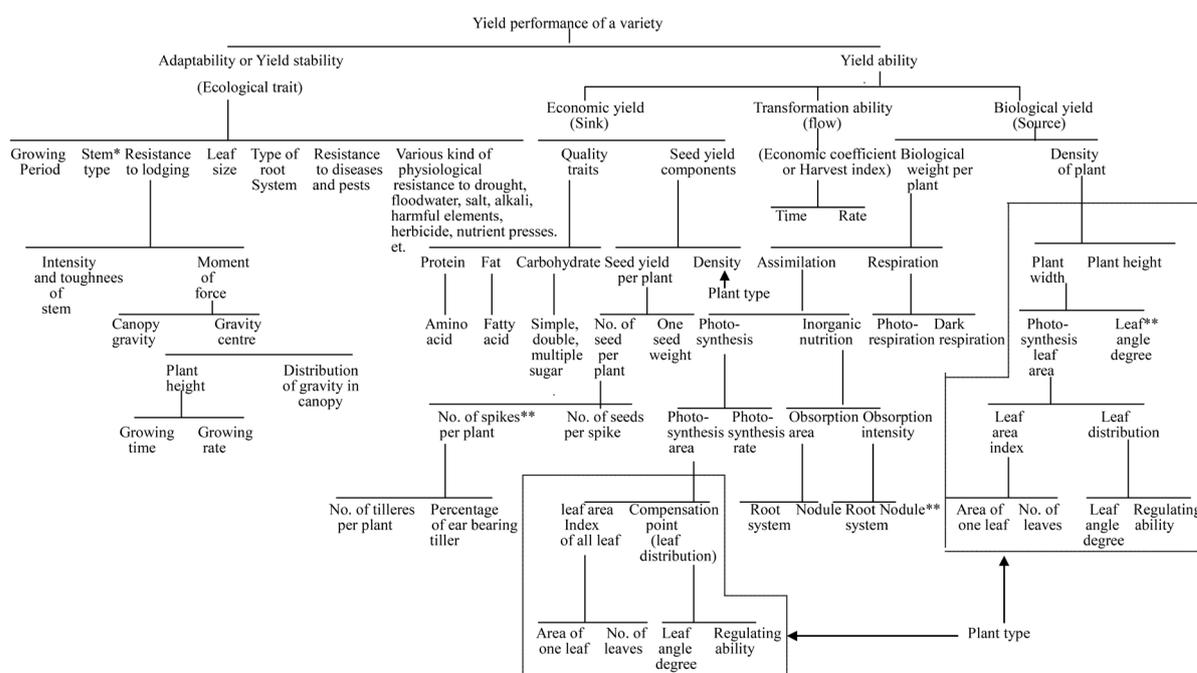


Figure 1. Net system of basic contradiction of variety yield performance and characteristic composition of crops; *The stem type was pod bearing habit in soybean. **There were petiole (and its length) and nodule, No. of pod per plant, No. of seed per pod in soybean.

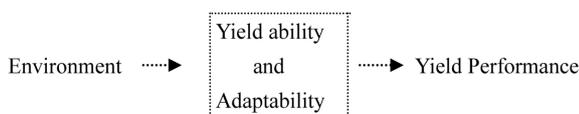


Figure 2. Basic contradiction of yield display of a variety: yield-ability and adaptability.

Thirdly, all of yield ability traits and reciprocal relationships among these yield ability traits were determined. They were mainly based on research accomplishments of crop physiology [9], using axiom method [10] to set up complete theory system of yield ability and net system of trait components [2].

It was obvious that if there only was test, no support of advanced philosophy thinking and scientific theory thought and scientific method theory, the basic principle of crop breeding could not be completed.

Basic principle of crop breeding was first time discovered and revealed in the paper in English. Study on net system of characteristics genetics of yield display of a variety was a great theory problem that was whole or overall in crop studies. Evolvement trend of crop cultivar in future can be scientifically foreseen by this study achievement. Development of studies on breeding and cultivar, characteristic inheritance will be greatly promoted. This net system was also the basis of studies on molecule genetics. The basic principle was a milestone transforming experience breeding into scientific breeding of crops, also a transition milestone from Mendel's genetics that could only explain quality characteristics inheritance into both quality and quantity, and was a great breakthrough of studies on genetics and breeding of crops.

2. Technique System of Crop Breeding

2.1. Ecology Breeding (or Yield Stability Breeding) and Its Main Inclusion

Ecology breeding was the breeding improving ecology characteristics and enhancing yield stability of variety. Research inclusions were mainly producing conditions and essence, classification, inheritance and variation, adaptive form and adaptive area division, breeding of all ecological characteristics, study on enhancing extensive adaptability of varieties.

2.2. Breeding of Yield Ability and Its Main Inclusion

Yield ability breeding was the breeding improving yield ability characteristics and enhancing yield ability (or potential) of varieties. Main study inclusions were improving seed yield per plant and its component parts, economic coefficient (transformation ability), biological yield per plant and its composition parts, plant shape etc.,

Table 1. Establishing study room (group), study content and flow chart in a new type institute of crop.

Type	Group (room)	Research content or task	Flow chart
Ecological breeding	1	Ecotype characteristics for natural climate factors and its wide-ranging adaptability	
	2	Ecotype of root system, root amount and its absorption rate, resistance to pressure for large amount elements	
	3	Resistance to diseases and insect pests and multiple resistance	
	4	Resistance to drought, excessive water, salt, alkali, harmful elements and multiple resistance of cultivars	
Yield-ability breeding	1	Seed yield (sink) and its components, economic coefficient or harvest index (flow)	
	2	Plant morphotype, biological yield (Source), photosynthesis	
Quality breeding	1	A large number of nutrition components in seed	
	2	Small amount of components in seed	
Study on high-yielding environment		Character of high-yielding community, utilization of illumination and soil fertility, regular pattern of high-yielding technique	
Synthetic study	1	Synthesis and breeding of breeding material and new germplasm completing in above groups	
	2	Synthesis and development of new cultivar and its high-yielding culture technique	
Breeding of transformation gene		Transferring exceptional gene into a crop	
Storeroom of germplasm		Accumulating and preserving advantageous genes and genotypes	

and comprehensive breeding study of yield ability traits, analyzing and studying basic regularity of yield ability breeding.

Quality breeding belongs to a part of seed yield breeding (sink) in yield ability breeding. Seed yield itself existed in contradiction and contradiction movement of “quality” and “quantity”.

3. Suggestion on Personnel Organization System and Division (Coordination) in a New Type of Crop Institute (Table 1)

Modern science study should be combination of applied technique research with directive basis research, single item research with synthetic research. **Table 1** showed that ecologic breeding, yield ability breeding, and quality breeding had separately four, two, two study contents, each of content included some breeding directions or objectives. Main objective of each of breeding directions including transformation gene breeding was different. Most important task of each objective was selecting breeding material that had a certain excellent character and high synthetic level of characters. Obtained such breeding materials should be used by synthetic study group1 in synthetic breeding and commercial varieties were bred. High-yielding cultivation technique of the commercial varieties should be researched by synthetic study group2 and used in crop production.

4. Conclusion

The net system both deciding reciprocity among over one hundred characteristics and forming mechanism of seed yield performance had been determined through research in thirty-one years. This was basic principle of engineering of crop breeding. It was a great breakthrough of studies on genetics and breeding of crops, will have important significance for development of genetics, breeding science and breeding practice. It was a milestone transforming experience breeding into scientific breeding of crops and a transition milestone from Mendel's genetics that could only explain quality characteristics inheritance into both quality and quantity. The basic principle also will be the important theory basis of study on molecule genetics of crops.

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