



Selecting Firstly Vegetative Body Characters Being an Important Way of Crossing Breeding of Crops

Peizhan Tian

Centre of Germplasm Introduction and Crop Breeding of Jilin Province, Changchun, China
Email: peizhantian@163.com

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Abstract

Small leaf blade was 1st selected and bred new variety Pinandou 8, its biggest LAI was 6.5, obtaining 5114 kg/hm² highest yield. Its yield stability also was the best. Because small leaf blade was first selected, thin stem, more branches and long branches and more nodes were induced and produced. Also, we can say that selection of small leaf blades guided the change of enlarging way of the vegetative body. This showed that adjustment of a balanced relationship of unity of opposites among traits or genes was amazing in process of producing a new variety, and also showed that new science breeding of crops should be used in using a voluntary selection of new vegetative body characters to create a new type of variety and enrich basis of germplasm resources. Wave motion of yield among years was larger by far than that among varieties and its reason to even more pay attention to yielding the stability of variety. The combination type of adapt-stable-yielding characters to be determined before was obviously different from the combination type of adapt-stable-yielding characters of Pingandou 8 at present. "Influence of each other actions among important ecology characters to cultivar yield stability" is a very important studying question. Vegetative body character was the basis of reproductive body character in yield ability traits, so vegetative body trait was more by far than reproductive organ traits, genetic relations among vegetative body characters also was complicated more than that of reproduction organ characters. Firstly, selecting vegetable body character (small leaf blade) changed the enlarging way of the vegetative body and then appeared beneficial variation in raising seed yield. Botany (Crop Science) original theory told us that crop yield performance is more than 40 ecology adapting characters and 100 yield ability characters together acted to form, but only a few seed yield traits were selected and used, rest more than 90% characters not, so increasing yield potential of crossing breeding of crops was very big. Present crop crossing breeding only was a primary stage of crop

crossing breeding (experience breeding stage), breeding under guidance by using Botany (Crop Science) original theory was only when a high stage of crossing breeding, or scientific breeding stage. Breeding Pingandou 8 was exactly a try of scientific breeding. We looked forward to its coming.

Subject Areas

Agricultural Science

Keywords

Crop Crossing Breeding, Vegetative Body Character, Selection Way

1. Introduction

Vegetative body character was the basis of reproductive body character in yield ability traits, so vegetative body trait was more than by far reproductive organ characteristics, genetic relations among vegetative body characters also were complicated more than reproduction organ characteristics [1]. What is the effect of selecting firstly vegetative body traits? Reducing a leaf blade and increasing LAI and seed yield were my 1st tentative plan in the breeding of improving plant type in soybean, how is the result? Botany(Crop Science) original theory told us that crop yield performance being more than 40 ecology adapting traits and 100 yield ability traits together acted to form, but only a few seed yield traits were selected and used, rest more than 90% characters not. If selecting not seed yield traits, may obtain high yield? Above mentioned three questions all needed answering and these were the purpose of the research.

2. Improving Firstly Vegetative Body Trait to Bred New Variety Pingandou 8

My 1st tentative plan in the breeding of improving plant type in soybean was reducing a leaf blade and increasing the leaf area index of population and seed yield. Only one cross to be done, to do the exploring, but it was a success had my wish fulfilled. A new variety, Pingandou 8 [1] with a small and linear shape leaf was bred. The leaf area index of two parents was 4.0 and 4.7, generally common varieties were around 4.5 - 4.8, but Pingandou 8 went up to 6.5, increasing 30% compared with common varieties. The growing period of Pingandou 8 was 130 days, Suinong 4, early-maturing parent 110 days and late-maturing parent, Liaodou 2 was 140 days. Pod-bearing habit of Pingandou 8 was typically indeterminate, being similar to Suinong 4. Producing these two important traits is mainly influenced by the inheritance of the two parents. Due to its typical indeterminate, Pingandou 8 had an early and longer flowering stage, its stem was thin and tough, resistant to lodging. But in its yield ability traits, no one was similar with two parents. Due to its leaf blade was linear, length and width of the biggest leaf blade in a plant respectively were 15 cm and 4 cm, area of middle leaflet of a

simple leaf only had 42 cm², but leaf area index went up to 6.5 when planting density was 10 plants/m², the reason was that simple plant had 70 - 90 leaf blades and 3 - 4 effective branches that had similar height and nod number with the main stem, and second branches on 1st branches podded. Pingandou 8 had the most examples of more than 4000 kg/hm² and the highest yield was 4882 kg/hm² in Liuhe County in 1998. Farmer Liuzhanshan created 5114 kg/hm² highest-yielding record in Jilin province by using Pingandou 8 and he was from Changling country in Shuangyang district in Changchun city. The yield stability of the variety was the best, its yield wave motion index among ten years only was 42.9% and Changnong 5 (ck) was 75.2%.

3. On the Basis of Above-Mentioned, Several Problems to Be Discussed

3.1. Mechanism Forming Yield in This Variety, Pingandou 8 (Figure 1)

Starting from selecting small leaf blade:

Because small leaf blade was firstly selected, thin stem, more branches and long branches and more nods were induced and produced, small leaf blade not required support and supplying nutrition of thick stem. As a result, combination of small leaf blade with more leaf blades and bigger LAI and high seed yield was produced. Also, we can say that selection of small leaf blade guided change of enlarging way of vegetative body.

More effective branches and long branches and more nods of Pingandou 8 all were surpassing parental plant and never were seen in soybean breeding in 40 years. The combination of early bloom, long bloom stage, longer growing period with typically indeterminate pod-bearing habit, the combination of thin stem and its toughness with small leaf blade, the combination of more and long and effective branches with fairly more leaf blade produced the combination high-yielding with stable yielding. This showed that adjustment of balance relationship of unity of opposites among traits or genes was amazing in process of producing a new variety, and also showed that new science breeding of crops should be used in using voluntary selection of new vegetative body character to create new type of variety and enrich basis of germplasm resources.

3.2. Stability of Variety Yield Being Even More Important than High Yield

Yield stability of variety was largest restriction factor raising yield performance. Under condition of lower production level and ability of man resistance to natural calamity being worse, wave motion of yield performance among years was

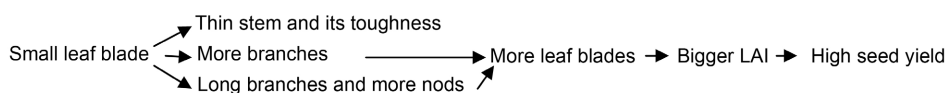


Figure 1. Mechanism forming high seed yield in the variety, Pingandou 8.

large. For example, yield test of six soybean varieties was conducted in ten years during 1996-2005, result showed that total mean yield of six varieties in ten years was 2974 kg/hm², mean yield of highest yielding variety, Pingandou 8, was 3189 kg/hm², lowermost Changnong 5, 2785 kg/hm², highest variety increased 14.5% than lowermost variety [2].

The ten years were divided by using harvest, 2004 year was bumper harvest year and mean yield of six varieties was 3790 kg/hm², 1997 and 2000 years were famine year (all were dry), 2260 kg/hm², 2005 year was lean year (more rain and low temperature), 2585 kg/hm², all the other six years were common year and 3140 kg/hm². Bumper year increased 20.7% than common year, 46.6% than lean year, 67.7% than famine year; common year increased 21.5% than lean year, 38.9% than famine year (Table 1). It showed wave motion of yield among years was larger by far than that among varieties and its reason to even more pay attention to yielding stability of variety [3].

3.3. Bring Forth New Ideas and Forming Type Combination of Ecological Characters and Raising Yield Stability of Variety

The combination type of adapt-stable-yielding characters to be determined before in middle area of Jilin province was obvious different with combination type of adapt-stable-yielding characters of Pingandou 8 at present. Before was middle maturing, semideterminate pod-bearing habit, stronger stem and resistance to lodging, middle or slightly big lance-shaped leaf, resistance to soybean mosaic. Pingandou 8 had the best ecological adaptability, its type combination of ecology was being partial to middle-late maturing, typically indeterminate pod-bearing habit, thin and toughness stem, resistant to lodging, small and linear leaf, resistant to disease (soybean mosaic). It showed that each other actions among ecology traits had big influence to yield stability. Along with development of scientific breeding and variety type increasing, yield stability of varieties was also certainly produced change. Research on influence of type combination of ecology trait to variety yield stability should be deeply conducted. But crop breeding circles very few pay attention to studying variety yield stability and this was a big

Table 1. Comparisons of yielding stability of six test varieties of Pingandou 8, etc.

Year combination and harvest	Variety	Mean yield (kg/hm ²)	(Highest-mean)	(Mean-iowest)	Change index (%)
			Mean (%)	Mean (%)	
1996-2005, ten years Harvest sequence: CFCCFCCCBL 1B 6C 1L 2F	Jilin 30	2906	34.5	34.3	68.8
	Jidou 3	3080	24.9	23.5	48.4
	Pingandou 8	3189	21.0	21.9	42.9
	Changnong 5 (CK)	2785	49.5	25.7	75.2
	Jiunong 21	3024	24.9	28.5	53.4
	Jidou 1	2858	19.6	37.2	56.8

B: bumper, C: common, L: lean, F: famine.

regret. "Influence of each other action among important ecology characters to cultivar yield stability" is a very important studying question [3] [4].

3.4. Relationship between Vegetative Body Character and Reproductive Body Characters in Yield Ability Traits

Vegetative body character was basis of reproductive body character in yield ability traits, so vegetative body trait was more by far than reproductive organ characters, genetic relation among vegetative body character also was complicated more than reproductive organ characters [1]. If firstly selecting vegetative body character, variation will be even more complicated and even to the extent that appear never existed before and beneficial variation, to such an extent as to influence and bring along advantageous variation of seed yield. Breeding Pingandou 8 (Figure 2), a new variety, gave thus enlightenment. This showed that firstly selecting vegetable body character (small leaf blade) changed enlarging way of vegetative body and then appeared beneficial variation raising seed yield.

3.5. Botany (Crop Science) Original Theory and Scientific Breeding of Crops

Botany (Crop Science) original theory told us that crop yield performance being more than 40 ecology adapting characters and 100 yield ability characters together acted to form, but only a few seed yield traits were selected and used, rest more than 90% characters not, so increasing yield potential of crossing breeding



Figure 2. New variety, Pingandou 8. Above from left: 1. Flower at top, 2. Harvest 5114 kg/hm², 3. Mature plant. Lower, from left 1. Leane shape leaf blade, 2. Seedling stage plant, 3. Vegetative body branches.

of crops was very big [5]. Present crop crossing breeding only was a primary stage of crop crossing breeding (experience breeding stage), breeding under guidance by using Botany (Crop Science) original theory was only when a high stage of crossing breeding, or the scientific breeding stage. Breeding Pingandou 8 was exactly a try of scientific breeding. We looked forward to its coming.

4. Conclusions

Breeding of Pingandou 8, a new variety with high yielding ability showed that when small leaf blades to be as the first purpose of plant type breeding of crops, two parents all should have small leaf blade genes and more branches genes. Because small leaf blades can induce and produce more and even longer branches and to go a step further produce even more leaf blades due to adjustment of the balanced relationship of unity of opposites among symmetry traits or genes was amazing in process of producing a new variety. As a result, the combination of small leaf blades with more leaf blades and bigger LAI and high seed yield was produced. Also, we can say that selection of small leaf blades guided the change of enlarging way of the vegetative body. Pingandou 8 had the best ecological adaptability, its type combination of ecology was partial to middle-late maturing, typically indeterminate pod-bearing habit, thin and toughness stem, resistant to lodging, small and linear leaf, resistant to disease (soybean mosaic).

The combination of an early bloom, long bloom stage, longer growing period with a typically indeterminate pod-bearing habit, the combination of thin stem and its toughness with small leaf blade, the combination of more and long and effective branches with fairly more leaf blade produced the combination of high-yielding with stable yielding. This was for breeding purposes of crops in regions of rainfall < 600 mm in crop growing period in the Northeast area of China.

Conflicts of Interest

The author declares no conflicts of interest.

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