Jour. Agric. Res. China (中華農業研究) 45(4) : 319~335 (1996)

Genetic Analysis of Amylographic Viscosity Measurements of Milled Rice by Means of Diallel Graph[1]

Yih-Chuan Kuo[2], Bill D. Webb[3] and James W. Stansel[4]

Abstract : Amylographic viscosity measurements, a physical property of milled rice flour, are important eating and processing quality parameters of rice and are characteristics of the endosperm. A genetic study on amylographic viscosity measurements of milled rice flour by means of diallel graph was conducted. An additive-dominance model with independence of the genes in action and in distribution is demonstrated by the excellent unit-slope linearity for all viscosity measurements. Data from regression lines of Wr on Vr and Yr and (Wr+Vr) indicate that lower peak viscosity, lower hot-paste viscosity, lower breakdown viscosity, higher setback viscosity and higher consistency viscosity are dominant and cool viscosity is ambidirectional. However, the degree of dominance for all measurements are incomplete or partial with an exception of peak viscosity in which the complete dominant gene effects is observed. The genetic nature of the parental entries in relation to amylographic viscosity measurements evaluated is discussed in detail.

Key words : Amylographic viscosity measurements, Endosperm characteristics, Diallel graph, Genetic nature.

INTRODUCTION

Amylographic viscosity measurements, a physical property of milled rice flour, and amylose content, a chemical property, are important eating and processing quality parameters[18] and are characteristics of the endosperm, which is a triploid tissue resulting from the fusion of one sperm nucleus with the two ploar nuclei of the egg. Thus, reciprocal differences (including maternal and/or dosage effects, xenia) are supposedly existed. Furthermore, for endosperm characteristics, an individual is a seed, not a plant. That is, these characteristics should be measured on a single grain basis[10]. Unfortunately, there are many endosperm characteristics which are difficult to measure on the basis of a single seed. Thus far, a method for determining amylose content on the basis of a single grain has already been developed[12]. However, determination of amylographic viscosity measurements was not yet developed. Traditional amylographic analysis developed by Halick and Kelly[3]

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and modified for use at the Regional Rice Quality Laboratory, USDA, is based on 50 g of rice flour (grinding about 3000-3500 milled rice grains) in 450 ml distilled water.

Up to the present, a satisfactory quantitative genetic model for such endosperm characteristics has not yet been developed although much attention has been recently devoted to the quality of crop products[10]. Fortunately, according to Hayman[4], when failure of the assumptions has been demondtrated, it is possible to draw the (Wr, Vr) graph and to make estimates of components of variation and other important genetic parameters. Therefore, the diallel cross analysis was used in this experiments. The results presented were based on a bulk sample of seeds which are advanced one generation form the donor plant. For example, F_1 hybrids are represented by bulk F_2 endosperm populations. These flaws mentioned above should be kept in mind.

The regression graph of covariance (Wr, the covariance between these offspring and their non-recurrent parents) and variance (Vr, the variance of all the offspring of the rth parent) of the parent arrays in a diallel cross provides a useful means of assessing genetic relationship among homozygous parents. As Hayman[4], Jana[5], Jinks[6] and Mather and Jinks[9] have shown, the regression graph of Wr on Vr prospectively provides information on four points. First, it supplies a test of the adequacy of the model; in absence of non-allelic interaction and with independent distribution of the genes among the parents Wr is related to Vr by a straight regression line of unit slope. Secondly, given that the model is adequate, a measure of the average level of dominance is provided by the departure from the origin of the point where the regression line cuts the Wr axis. It is partial (incomplete) dominance when the intercept is positive; complete dominance when the regression line passes through the origin, overdominance when the intercept is negative. Thirdly, the relative order of the points along the regression line indicates the distribution of dominant and recessive genes among the parents: the points nearest the origin stem from the arrays derived from parents with most dominant genes and the points furthest from the origin stem from arrays derived from parents with fewest dominant genes. Finally, the remaining information that can be obtained from regression of Wr on Vr is the dirction of the dominance. Comparison of (Wr +Vr) (parental order of dominance) with Yr (parental measurement) indicates whether the distribution of dominant to recessive alleles is correlated with the phenotype of the common parent. The correlation will be negative if the parents with a high score, i.e., those containing most increasing genes, have the lowest values of Wr+Vr, i.e., contain most dominant genes, and positive if the reverse is true. However, if the correlation is non-significant but there is significant dominance, then, dominance is ambidirectional.

In order to further explore the gerntic nature of parental entries used for amylographic viscosity measurements evaluated, genetic analysis by means of diallel graph is presented in this report.

MATERIALS AND METHODS

All possible cross-combinations, including the reciprocals, were made among six rice entries, "Rexmont", "Guichow", "Lemont", "CI 9902", "Toro II", and "Taichung Sen No.

10″ (TCS 10), reprseenting an array of different levels of amylogeaphic viscosity measurements as shown in Fig. 1 and Table 1. The six parents and one set of F_1 hybrids, 30 combinations, were transplanted and cultivated in a flooded paddy field at the Texas A&M University Agricultural Research and Extersion Center near Beaumont, Texas, in a randomized complete block design with three replications. Each block consisted of 36 four-row plots. Each plot included 40 plants spaced at 30×30 cm. Twenty plants from the two central rows of each plot were harvested and analyzed.

Amylographic viscosity measurements were determined by the method devloped by Halick and Kelly[3] and further modified for the use at the Regional Rice Quality Laboratory, USDA, Beaumont, Texas, using a Brabernder Visco/Amylograph with 700 g•cm cartridge and 75 rpm speed (C. W. Brabender Instruments Inc., S Hackensack, NJ). The procedure is outlined as the following. Milled rice sample (about 55-60 g) was ground in a No. 3 Wiley mill equipped with a 0.5 mm screen (do not grind samples more than one day in advance). 50 g of the ground milled rice (12% moisture basis) with 350 ml distilled was blended in a Waring Blender for 1.5 minutes. After blending, the rice-water slurry was rapidly transfrred to the Amylo-Visco-Graph bowl and the transfer was completed quantitatively with an additional 100 ml of distilled water. Thus, the final concentration of the slurry in the Amylograph cup was then 50 g of ground rice in 450 ml distilled water. The Amylogeraph senstivity element was positioned and the thermoregulator was set at 50 °C as the staring temperature. When the temperature reached 50 °C (about 7-8minutes), the chart was adjusted to the zero minute marking and the slurry was then heated to a temperature of 95 °C at a rate of 1.5 °C per minute with the Amylograph control in the "UP" position. When 95 °C was attained (about 30 minutes) the Amylograph control was switched to the "NEUTRAL" position and the paste temperature then was maintained at 95 °C for 10 minutes. After 10minutes of cooking, the cooling solenoid was turned on and the Amylograph control was switched to the "DOWN" position. This permitted paste to cool at a rate 1.5 °C per minute. The curve of amylographic profile was terminated when the paste was cooled to a temperature of 50 °C (about 30 minutes). Significant points in the paste curve are: peak viscosity, hot-paste viscosity (viscosity after cooking at 95 °C for 10 minutes) ; and cool-paste viscosity (viscosity when cooled to 50 °C), all in Brabender Units. Three derivative viscosities, amylographic breakdown, setback, and consistency are calculated from these basic viscosities.

The analytical method is based mainly on Hayman's theory and analysis of diallel crosses[4]. The relative positions of genotypes used with respect to parental measurement (Yr) and parental order of dominance (Wr+Vr) are supplemented with a second graphic treatment based on the standardized deviation of the Yr and the (Wr+Vr), followed by the formula of Johnson and Aksel[7]. Here, the rth array refers to the series of crosses in a diallel in which the rth parent was a recurrent parent. Thus, in this six-parent rice diallel cross experiment, array 1 means that Rexmont (1) is the recurrent parent in all combinations, i.e., 1×1 (parent selfing), 1×2 (Guichow), 1×3 (Lemont), 1×4 (Cl 9902), 1×5 (TCS 10), and 1×6 (Toro ll).

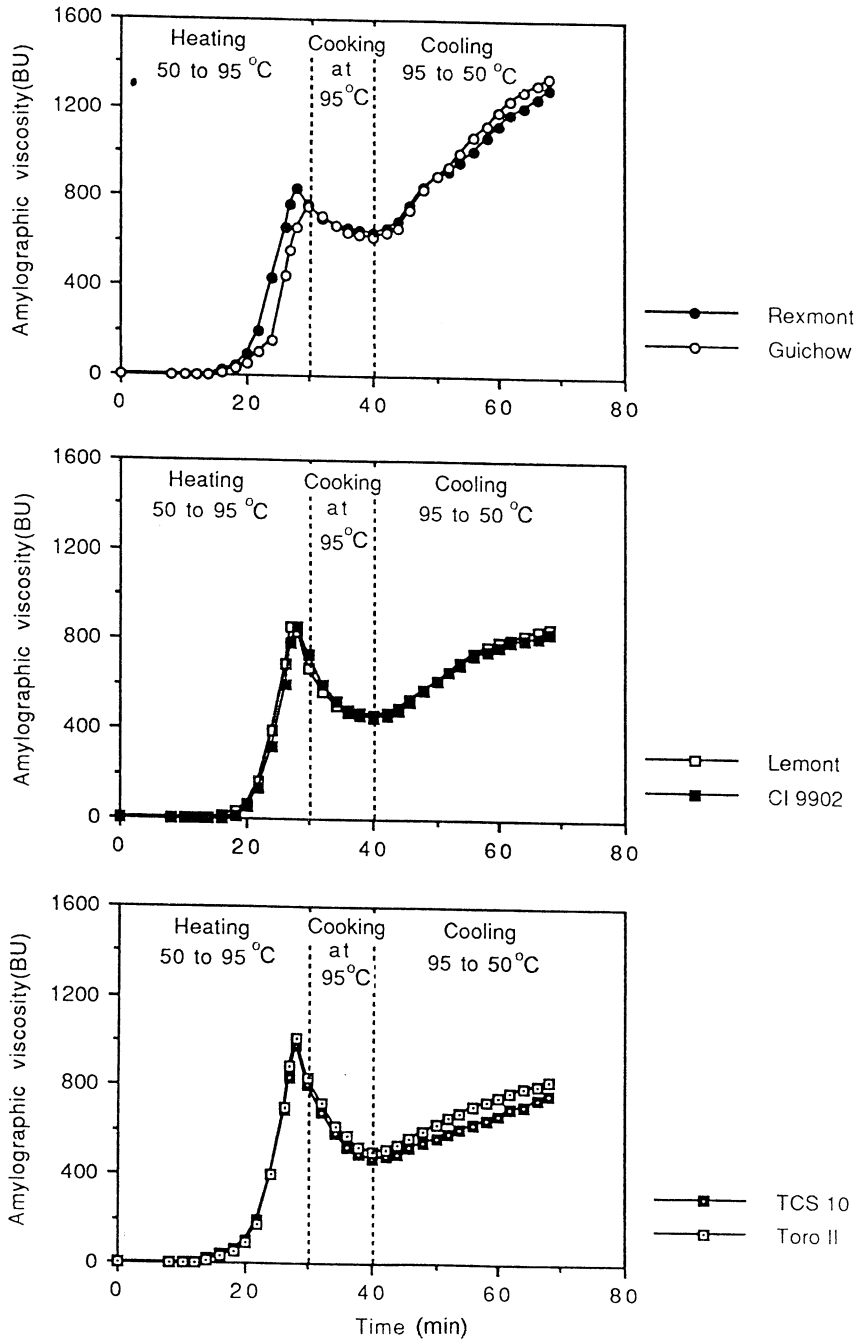


Fig. 1. Amylographic profiles of the six parents used in the diallel cross.

Table 1. Mean values of amylographic viscosity measurements of the six parental entries

Parents	Amylographic viscosity[z]					
	Peak	Hot-paste	Cool-paste	Breakdown	Setback	Consistency
Rexmont(P1)	833	640	1,290	193	457	650
Guichow(P2)	747	620	1,340	127	593	720
Lemont(P3)	843	463	857	380	13	393
CI 9902(P4)	853	470	843	383	−10	373
TCS 10(P5)	997	490	757	507	−240	267
Toro II (P6)	1,010	510	803	500	−207	293

[z] Brabender Unit.

RESULTS AND DISCUSSION

Traditional analyses of variance for viscosity measuremets evaluated revealed highly significant differences among treatments (parents and hybrids) (Table 2), indicating the presence of genotypic variability in these populations used. Further detailed analyses on viscosity measurements were, therefore, performed. The results are presented by individual characteristics as the following.

Table 2. Analysis of variance for amylographic viscosity measurements of rice

SOV	DF	Mean square					
		Peak	Hot-paste	Cool-paste	Breakdown	Setback	Consistency
Block	2	485.5	398.5	156.8	164.2	260.0	65.1
Treatment	35	7,440.7**	2,770.7**	29,283.0**	13,219.4**	54,799.4**	15,347.8**
Error	70	0.26	191.5	90.9	139.4	215.1	98.1

** Significant at the 0.01 probability level.

Amylographic Peak Viscosity

As mentioned above, there are three basic amylographic viscosity measurements: amylographic peak viscosity, amylographic hot-paste viscosity, and amylographic cool-paste viscosity in an amylographic profile. From which, amylographic breakdown viscosity, amylographic setback viscosity, and amylographic consistency viscosity can be calculated. Amylographic peak viscosity is the viscosity when a aqueous suspension of starch of a given concentration is heated. Peak viscosity usually occurs before of after the temperature of the suspension has reached to 92-95 °C. Amylographic peak viscosity is a measurement of the ability of the known starch granules to swell markedly before rupturing. Typical U. S. long-grain rice cultivars usually show an intermediate peak viscosity[13,15,16,17]. Scientists in Japan [11] and in Taiwan, ROC.[8] found sticky cooked rice has higher peak viscosity. Thus, amylographic peak viscosity is an important index for evaluating rice grain quality.

The graphic analysis of data on amylotraphic peak viscosity of milled rice flour from the

six-parent rice diallel cross is given in Fig. 2. The regression line, Wr (the covariance between these offspring and their non-recurrent parents) on Vr (the variance of all the offspring of the rth parent), is significantly different from zero and does not differ significantly from the unit slope. The excellent unit-slope linearity demonstrates validity of the assumptions on which the method is based: an additive-dominance model with independence of the genes in action and in distribution. The regression line nearly passes through the point of the origin, indicating an almost complete dominance. However, this result could be due to complete dominance masked by bulking. The positions of the array points (Vr, Wr) along the regression line revealing the relative proportions of dominant and recessive genes in the parents are: Toro II having predominantly recessive genes; Rexmont, Guichow, Lemont, and CI 9902 forming a group in which dominant genes predominate. However, the position of array 2, Guichow, is slightly deviated from the regression line, indicating that little genetic interaction might exist in this parent-array[7].

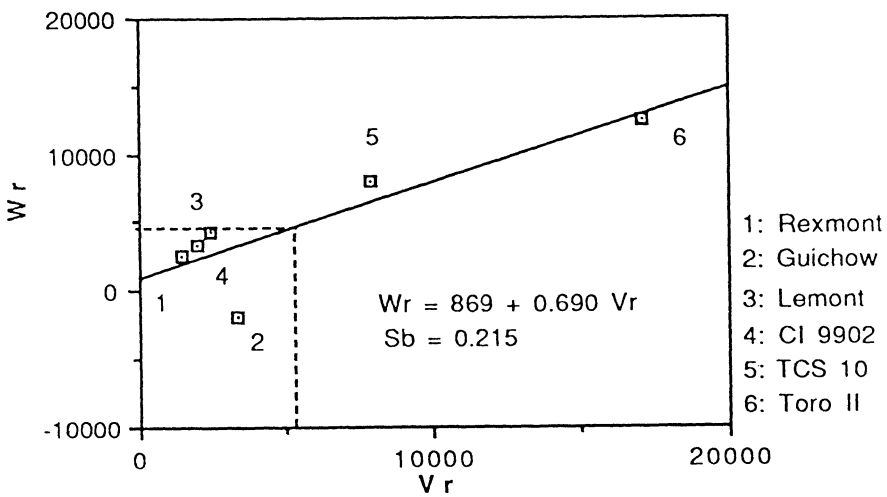


Fig. 2. Regression of Wr on Vr for amylographic peak viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

The theory of the diallel cross states that the parental measurement (Yr) is closely correlated with the number of positive (increasing) homozygotes in the parent while (Wr +Vr) bears the same relationship to the number of recessive homozygotes. The recessive (decreasing) genes are mostly positive when the correlation coefficient (r) between Yr and (Wr+Vr) is significantly positve. The dominant genes are positive (increasing) when r is significantly negative; When the r is non-significant the equal proportions of the dominant genes are negative (decreasing) and positive (increasing), i.e., ambidirectional dominanec. In the present study, the correlation between Yr and (Wr+Vr) for amylographic peak viscosity shows a marked linearity with a highly significantly positive correlation coefficient

(r=0.92**) between Yr and (Wr+Vr) indicates that high amylographic peak viscosity is associated with recessiveness, and low amylographic peak viscosity is associated with dominance.

Up to this point, the results inferred from the regression graph of Wr on Vr have indicated some basic genetic information about the parents used. The relative positions of entries used with respect to parental measurement (Yr) and the parental order of dominance (Wr+Vr) were further graphically surveyed (Fig. 3). As shown in Fig. 3, recessiveness (+) is shown by points above the horizontal line (parental measuremant) and dominance (−) is shown by points below this line. High parental measurement (+) is shown by points to the right of the vertical line (Wr+Vr) and low parental measurement is shown by points left of this line. Thus, TCS 10 and Toro II, located in the first quadrant, with a predominantly recessive genes produce a relatively high amylographic peak viscosity. Rexmont, Guichow, Lemont, and CI 9902, on the other hand, in the third quadrant, with maximum numger of dominant genes produce a relatively low amylographic peak viscosity. However, Guichow, possessing slightly more dominant genes than those of Rexmont, Lemont and CI 9902, show a relative low amylographic peak viscosity.

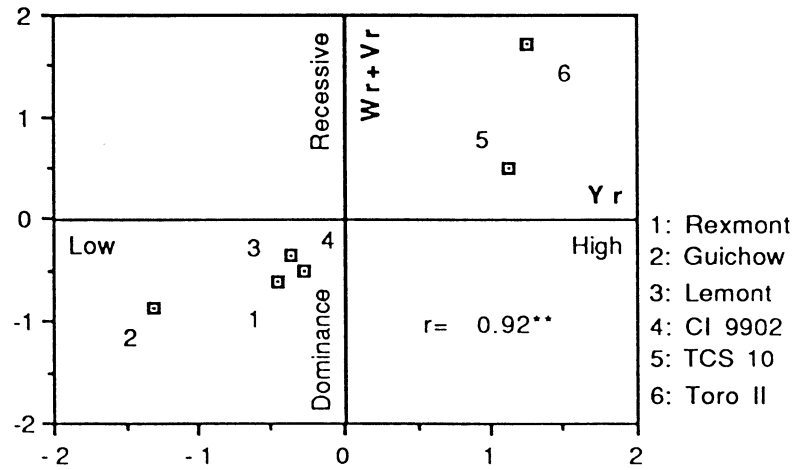


Fig. 3. Standardized deviation for amylographic peak viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr) .

Amylographic Hot-Paste Viscosity

Amylographic hot-paste viscosity is measured as the paste is cooking at a specified high temperature (usually 92-95 °C) for 10 minutes. The overall relationship between amylographic hot-paste viscosity and grain quality is not clear, although Lii et al.[8] reported that amylographic hot-paste viscosity significantly positively correlated with eating quality.

The graphical analysis of data on amylographic hot-paste viscosity form the six-parent rice diallel cross is illustrated in Fig. 4. The regression line is significantly different from

zero and does not differ significantly from unit slope as shown in Fig. 4. Thus, the excellent unit-slope linearity demonstrates adequacy of an additive-dominance model with independence of the genes in action and in distribution. The regression line crosses the Wr axis fairly high above the point of the origin, indicating a small degree of dominance, i.e., a slightly partial or incomplete dominance. However, this result could also be due to complete dominance masked by bulking.

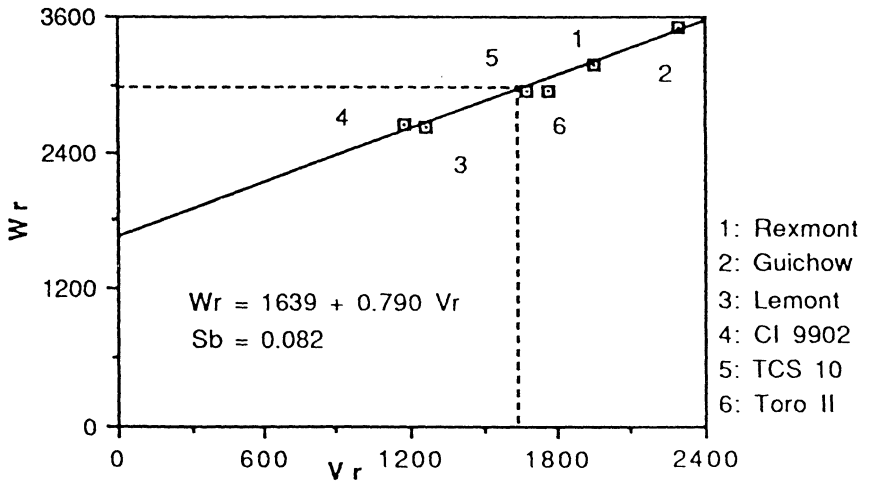


Fig. 4. Regression of Wr on Vr for amylographic hot-paste viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

The positions of all arrays are near the regression line, confirming very little genetic interaction. However, all arrays closely correspond to the points distant from the lower ends of the line. Guichow and Rexmont have, in that order, mostly recessive genes; Lemont and CI 9902 have, also in that order, more dominant genes; TCS 10 and Toro II have, on the other hand, recessive and dominant genes in nearly equal proportions as indicated by the fact that these two paraental arrays are located near the point which is intersected by the lines of the means of Wr and Vr of arays, especially TCS 10.

The standardized deviation graph of Yr and (Wr+Vr) were plotted (Fig. 5). As presented in Fig. 5, a significant correlation coefficient (r=0.82*) between parental measurements and parental order of dominance indicates that the association of lower amylographic hot-paste viscosity with dominance and of higher amylographic hot-paste viscosity with recessiveness is consistent, which reflects the order of dominance observed from Fig. 4. Among all parent arrays, Lemont and CI 9902 with most dominant genes show lower values for amylographic hot-paste viscosity; Rexmont and Guichow possessing mostly recessive genes produce relatively high values for amylographic hot-paste viscosity.

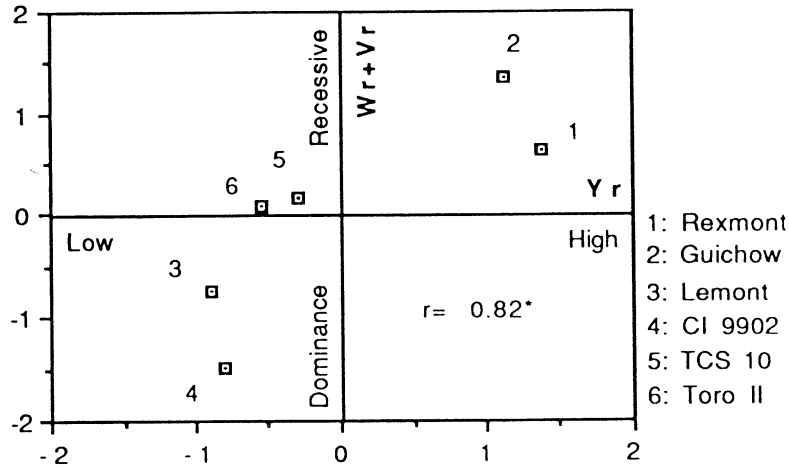


Fig. 5. Standardized deviation for amylographic hot-paste viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr).

Amylographic Cool-Paste Viscosity

Amylographic cool-paste viscosity is measured as the temperature of the paste is cooled down at a certain rate (usually 1.5°C/min.) to 50°C after a holding period (usually 10 minutes) at a specified high temperature (usually 92—95°C). Typical U. S. medium-and short-grain cultivars show a comparatively low cool-paste viscosity[13,15,16,17]. However, a higher amylographic cool-paste viscosity combined with lower amylographic breakdown viscosity has been correlted with superior parboil-canning characteristics and quick-cooking properties[18]

Data on amylographic cool-paste viscosity for the six-parent rice diallel cross were analyzed graphically (Fig. 6). The regression coefficient differs significantly form zero but not from unity, demonstrating validity of the assumptions on which the analysis is based. The regression line intersects the Wr axis significantly above the point of the origin, proposing a small degree of dominance among the arrays, i.e., partial or incomplete dominance. However, this result could also be due to complete dominance masked by bulking.

The arrays form two groups: TCS 10 and Toro II having, in that order, the maximum number of recessive genes; Rexmont, Guichow, Lemont, and CI 9902 forming a group in which dominant genes predominate. However, the position of this dominant group is near the intersection of the means of Wr and Vr of the arrays and far from the point of the origin, indicatig that these parents contain only slightly more dominant genes than recessive genes. Also, all group are positioned close to the regression line, indicating very little genetic interaction.

The correlation between parental measurement and parental order of dominance is a non-significant negative correlation ($r=-0.69ns$), indicating that equal proportions of the

dominant genes are positive (increasing) and negative (decreasing), i.e. ambidirectional dominance. This was further illustrated by the relative positions of parent-arrays plotted in Fig. 7. TCS 10 and Toro II, as shown in Fig. 7, with the most recessive genes, have a relatively lower amylographic cool-paste viscosity. In contrast, the dominant parental group can be divided into two groups: Rexmont and Guichow with some dominant genes show a relatively high amylographic cool-paste viscosity; on the other hand, Lemont and CI 9902 also with equal amount of dominant genes compared to Rexmont and Guichow show a relatively low amylographic cool-paste viscosity. The fact that equal proportions of dominant genes are positive (increasing) and negative (decreasing) can be confirmed form the observations made in Fig.6. and Table 1.

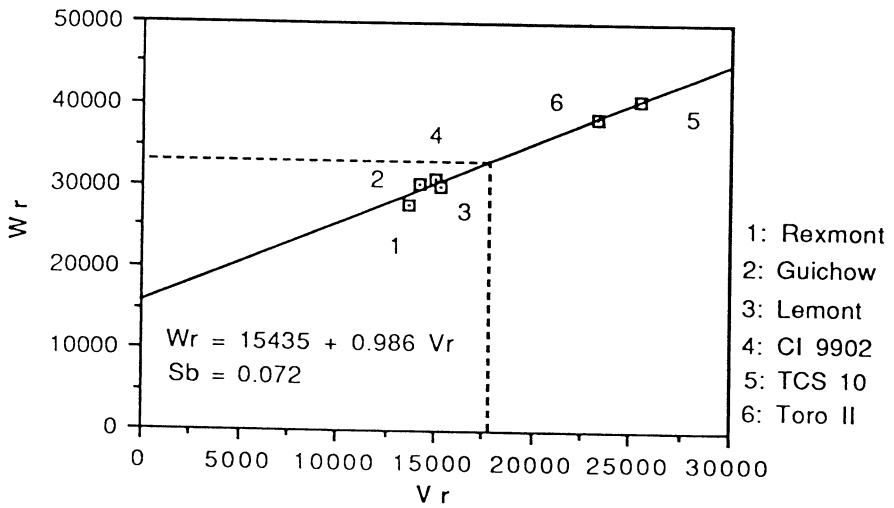


Fig. 6. Regression of Wr on Vr for amylographic cool-paste viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

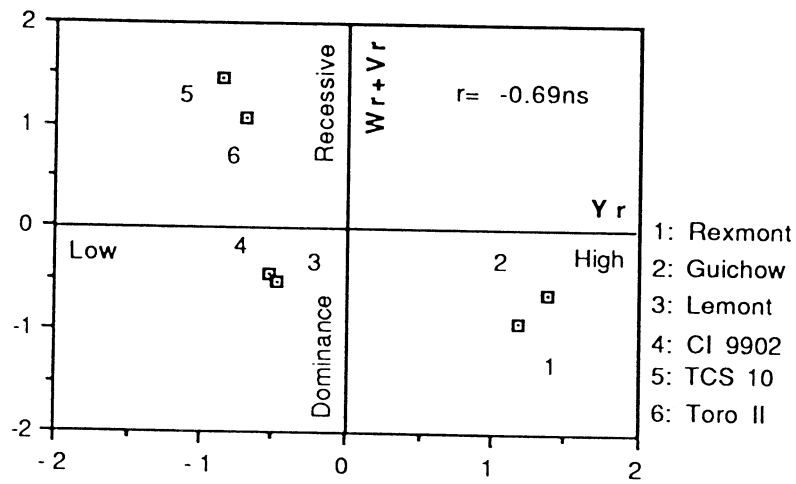


Fig. 7. Standardized deviation for amylographic cool-paste viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr).

Amylographic Breakdown Viscosity

There are three derivative amylographic viscosity measurements: amylographic breakdown viscosity, amylographic setback viscosity, and amylographic consistency viscosity. Amylographic breakdown viscosity is calculated from amylographic peak viscosity minus amylographic hot-paste viscosity and reflects the decrease in viscosity during cooking at 92—95°C.

Traditional U. S. long-, medium-, and short-grain cultivars show relatively high amylographic breakdown viscosity. In contrast, superior cooking and processing U. S. long-grain cultivars are characterized by an amylose content 2—4% higher than those of typical U. S. long-grain cultivars and a relatively low amylographic breakdown viscosity[1,2,14,16,18]. A low breakdown viscosity is indicative of lower loss of solids and little splitting and fraying of edges and ends in canning[18]. On the other hand, Japanese rice scientists suggested that amylographic breakdown viscosity could be selected as an index factor for palatability evaluation[11]. Published results from Taiwan, ROC. suggested a highly significant correlation between amylographic breakdown viscosity and eating quality[8]. Amylographic breakdown viscosity, therefore, could be considered as the most important index for evaluating grain quality among all of the six amylographic viscosity measurements.

The regression line, illustrated in Fig. 8, is significantly different from zero at the 1% probability level, and is not significant different from unity, indicating an additive-dominance model without the complication of gene interatcion. The regrassion line crosses the Wr axis slightly above the point of the origin, suggesting a moderate degree of dominance among the arrays. Therefore, partial or incomplete dominance is involved in conditioning amylographic breakdown viscosity. However, this result could also be due to complete dominance masked by bulking.

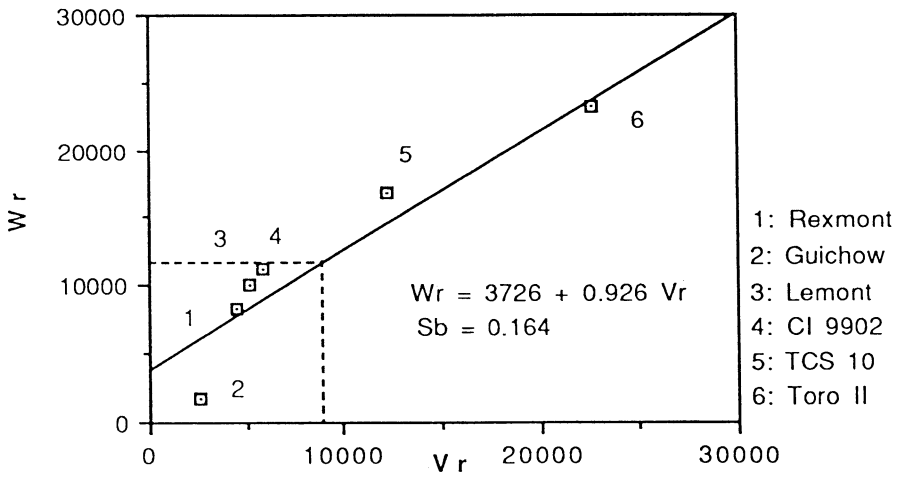


Fig. 8. Regression of Wr on Vr for amylographic breakdown viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

The order of the parental arrays along the regression line indicating the relative proportions of dominant and recessive genes among the parents are: Toro II possessing most recessive genes, and Guichow, the parent bearing the most dominant genes. Furthermore, the position of Guichw is slightly form the regression line, indicating little gene interaction might exist[7].

Standardized deviation graph of parental measurement (Yr) and parental order of dominance (Wr+Vr) were plotted (Fig. 9). The correlation coefficient is significant at the 5 % probability level (r=0.84*), suggesting an association between recessive and high amylographic breakdown viscosity and between dominance and low amylographic breakdown viscosity. The genetic nature of amylographic breakdown viscosity of the parents used is: TCS 10 and Toro II possessing most recessive genes and showing a relatively high amylographic breakdown viscosity; Rexmont and Guichow containing most dominant genes and having a relatively low amylographic breakdown viscosity; Lemont and CI 9902 with few dominant genes producing an intermediate amylographic breakdown viscosity.

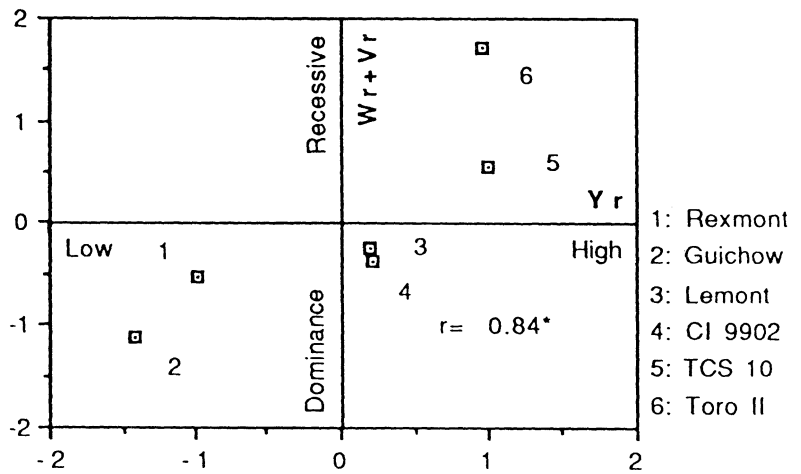


Fig. 9. Standardized deviation for amylographic breakdown viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr).

Amylographic Setback Viscosity

Amylographic setback viscosity is a derivative amylographic viscosity measurement calculated from amylographic cool-paste viscosity minus amylographic peak viscosity. Traditional southern U. S. long-grain cultivars show a slightly positive amylographic setback viscosity. Superior cooking andr Processing U. S. long-grain cultivars, on the other hand, show a higher amylographic sethack viscosity[1,2,14,16,18]. Thus, amylographic setback

viscosity is also an important index for evaluating grain quality although more attention has traditionally been paid to amylose content and amylographic breakdown viscosity.

The graphic analysis of amylographic setback viscosity is presented in Fig. 10. The regression line, Wr on Vr, is significantly different from zero and does not differ significantly from unit slope, demonstrating an additive-dominance model without the complication of gene interaction. The regression line cuts the Wr axis slightly above the point of the origin, indicating a small degree of dominance. However, this result could also be due to complete dominance masked by bulking, The positions for all arrays are near to the regression line. Toro II and TCS 10 have, in that order, predominantly recessive genes. Rexmont, Guichow, Lemont, and CI 9902 from a dominant gene group. Among this group, Guichow possesses the maximum number of dominant genes.

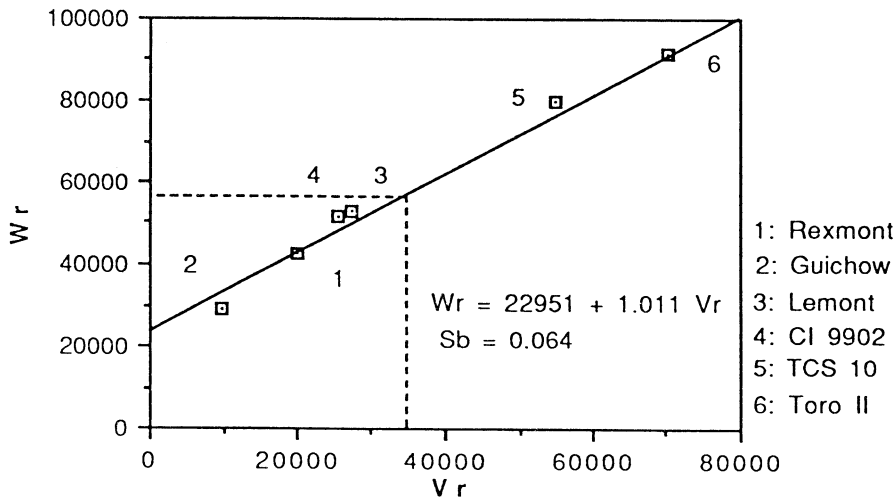


Fig. 10. Regression of Wr on Vr for amylographic setback viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

The standardized deviation graph for parental measurements and parental orders of dominance, given in Fig. 11, shows a marked linearity with a significant correlation, $r=-0.88^*$. The association of low amylographic setback viscosity with recessiveness and of high amylographic setback viscosity with dominance is consistent in Fig. 11. Among these parent arrays, TCS 10 and Toro II with the most recessive genes show a relatively low amylographic setback viscosity; Rexmont and Guichow, higher amylographic setback viscosity parents, possess mostly dominant genes; Lemont and CI 9902, intermediate setback viscosity arrays, contain a slight excess of dominant genes.

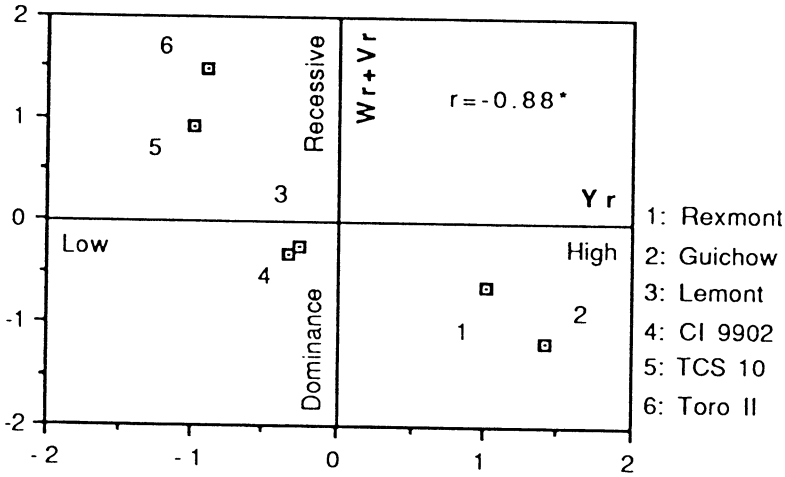


Fig. 11. Standardized deviation for amylographic setback viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr).

Amylographic Consistency Viscosity

Amylographic consistency viscosity is one of the derivative amylographic viscosity measurements calculated by subtracting amylographic hot-paste viscosity form amylographic cool-paste viscosity. Up to now, less attention has been paid to this measurement.

The graphic analysis of data on amylographic consistency viscosity is illustrated in Fig. 12. The regression coefficient is significantly different from zero, but not from unit slope, verifying the validity of the assumptions on which the analysis is based. The regression line intersects the Wr axis significantly above the point of the orgin, indicating a small degree of dominance among these parent arrays. However, this result could also be due to complete dominance masked by bulking.

From the positions of the arrays along the regression line, it is apparent that TCS 10 and Toro II both contain, in that order, the greatest number of recessive genes. Rexmont, Guichow, Lemont, and CI 9902 form a dominant gene group. However, Rexmont and Guichow possess more dominant genes than those of Lemont and Cl 9902.

The graph of standardized deviation of parental measurements and parental order of dominance for this characteristic is presented in Fig. 13. The correlation coefficient between these variables is significant at the 5% probability level ($r=-0.86^*$), suggesting an association between low amylographic consistency viscosity and recessiveness, and between high amylographic consistency viscosity and dominance. Thus, Rexmont and Guichow possessing the maximum number of dominant genes show a high amylographic consistency viscosity; TCS 10 and Toro II contaning the greatest amount of recessive genes produce a low amylographic consistency viscosity.

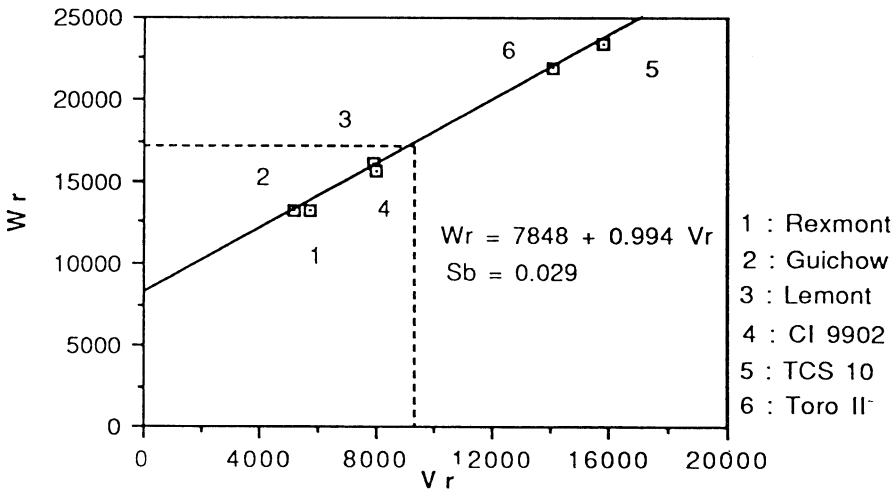


Fig. 12. Regression of Wr on Vr for amylographic consistency viscosity in the six-parent diallel cross, dotted lines showing the means of Wr and Vr of arrays, respectively.

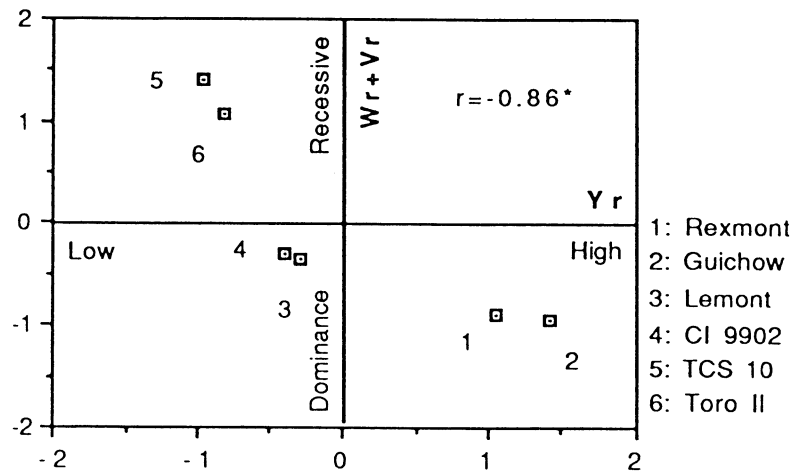


Fig. 13. Standardized deviation for amylographic consistency viscosity in the six-parent diallel cross, showing parental measurement (Yr) and parental order of dominance (Wr+Vr).

From the results presented above, it might concisely conclude that effective selection for targeted viscosity measurements can be easily done from the crosses between the parental entries used because of an additive-dominance model with independence of the genes in action and in distribution is demonstrated by the excellent unit-slope linearity for all viscosity measurements.

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白米澱粉糊黏度測定值之全互交遺傳圖析[1]

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摘 要

白米澱粉糊黏度測定值是稻米食用與加工品質非常重要之介量，屬胚乳性狀。本研究利用全互交遺傳圖析進行白米澱粉糊黏度測定值之遺傳分析。由各黏度測定值良佳之迴歸斜率線性獲證：基因作用與分布獨立之累加性一顯性遺傳模式適用於這些被評估之黏度測定值。圖析顯示：低高峰黏度、低熱糊黏度、低崩解黏度、高回饋黏度及高膠質黏度爲相對顯性；冷糊黏度爲雙向顯性。除高峰黏度爲完全顯性外，各該黏度測定值概呈不完全或部份顯性。文中曾就參試親本澱粉糊度測定值之遺傳特質詳細討論。

關鍵詞：澱粉糊黏度測定值、胚乳性狀、全互交遺傳圖析、遺傳特質。

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