Change of Amylogram Properties and their correlation after Cold Water Stress in Japonica Rice

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Objectives

This experiment was conducted to get the useful information on major changes of these factors associated with eating qualities after cold water stress.

Materials and methods

Six Japonica rice varieties and lines selected through cold water treatment in 2003 (Table 1) were used to examine major changes of factors associated with amylogram properties among eating qualities after cold water stress.

Cold water treatment(19℃±2) was performed from 30 days after transplanting to heading date. Six varieties and lines were harvested after 45 days heading date and these seeds adjusted as 15% water content. These varieties and lines's seeds were milled using milling machine(Satake; THV, Yamamoto, Japan). Amylogram characteristics were measured by Rapid visco analyzer(Newport Sci. RVA-4, Newport, Australia)

Results and Discussion

This study was focused on the change of eating quality properties and correlation among these characteristics after cold water irrigation. Among amylogram properties, starting gelatinization temperature and peak, hot, cool, breakdown viscosities were more decreased in treatment than control, but consistency and set back were increased after cold water irrigation. The increasing ratio of protein in milled rice was positively correlated with the decreasing ratio of peak viscosity and negatively correlated with the increasing ratio of consistency viscosity. The increasing ratio of amylose in brown rice was highly correlated with the increasing ratio of fatty acid and positively correlated with the decreasing ratio of peak, hot, and cool viscosity and negatively correlated with the increasing ratio of consistency viscosity.

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Table 1. Changes of the viscogram characteristics of rice flour and physical properties of cooked by Rapid visco analyser after cold water irrigation.

Varieties/line	Starting gelatinization temperature			Peak viscosity (RVU)		
	C	T	D	C	T	D
HR19621-AC6	69.5±0.3	68.3±0.8	-1.7±1.7	242.9±4.0	204.9±3.4	18.6±3.9
Sambaegbyeo	66.5±0.5	66.5±1.2	0±1.0	407.7±1.6	211.7±7.3	92.7±7.4
Unbong31	67.1±0.8	65.9±0.9	-1.9±0.2	405.9±2.3	231.9±3.0	75.0±3.3
Hitomebore	67.4±0.3	65.5±0.8	-2.9±1.6	284.7±7.5	257.6±14.1	10.6±3.1
Jinbubyeo	68.5±0.5	68.9±0.5	0.5±0.0	312.1±10.2	299.0±12.6	0.8±6.0
Stejaree45	66.3±0.3	66.2±0.5	-0.2±1.3	209.1±6.8	205.0±2.7	2.1±4.7
Mean	**67.5**^{b*}	**66.9**^{a}	**-1.0**	**310.4**^{a**}	**235.0**^{b}	**33.3**
LSD (5%)	1.28	ns	ns	15.9	19.4	12.3

Varieties/line	Hot viscosity (RVU)			Cool viscosity (RVU)		
	C	T	D	C	T	D
HR19621-AC6	163.2±2.4	137.4±0.8	18.8±2.5	270.7±0.9	259.0±10.2	4.6±4.5
Sambaegbyeo	284.5±0.1	140.0±8.5	103.6±12.5	394.0±14.3	252.1±8.0	56.5±10.6
Unbong31	304.5±7.4	166.4±2.1	82.9±2.2	425.5±0.7	285.0±2.5	49.3±1.6
Hitomebore	200.8±7.6	161.1±15.4	25.0±7.2	289.9±6.0	266.0±13.1	9.1±3.1
Jinbubyeo	206.7±2.6	188.6±0.8	9.6±0.9	321.3±5.5	299.0±12.6	1.3±4.4
Stejaree45	167.6±5.6	144.9±1.1	15.7±3.0	275.1±6.1	279.6±19.7	-1.5±4.8
Mean	**221.2**^{a**}	**156.4**^{b}	**42.6**	**329.4**^{a**}	**275.6**^{b}	**19.9**
LSD (5%)	14.2	17.6	12.2	20.1	18.6	10.0

Varieties/line	Breakdown (RVU)			Consistency (RVU)			Set back (RVU)		
	C	T	D	C	T	I	C	T	I
HR19621-AC6	97.7±6.5	67.4±4.2	18.7±16.9	107.5±1.6	121.6±9.4	11.4±5.6	27.8±4.9	54.2±13.5	45.8±22.6
Sambaegbyeo	123.2±1.5	71.7±1.2	71.8±0.8	109.4±14.2	112.0±0.6	2.3±12.2	-13.7±12.7	40.3±0.6	133.8±30.9
Unbong31	101.4±9.8	65.5±1.0	54.9±17.2	121.1±8.1	118.6±0.5	-2.1±7.3	19.7±1.6	53.1±0.5	63.0±3.4
Hitomebore	107.3±5.1	107.3±9.5	0.1±4.2	89.1±1.6	104.9±2.3	15.1±0.4	5.2±1.5	8.4±1.0	38.5±10.4
Jinbubyeo	111.8±1.3	115.9±19.5	-2.1±17.6	99.8±0.5	126.1±14.0	20.4±9.2	9.2±4.8	12.6±2.2	29.0±25.5
Stejaree45	41.5±1.3	53.3±5.8	-30.7±6.4	107.4±11.6	134.7±20.7	20.0±3.7	65.9±12.9	74.6±17.0	11.3±2.9
Mean	**90.2**^{a**}	**79.6**^{b}	**18.8**	**105.7**^{b**}	**119.7**^{a}	**11.2**	**19.0**^{b}	**40.5**^{a**}	**53.6**
LSD (5%)	12.5	22.2	34.7	ns	ns	ns	21.6	21.2	30.8

Table 2. Correlation coefficients between physiochemical and viscosity properties.

Relevant characters		Correlation coefficients
Spikelets fertility index	- Increasing ratio of protein in milled rice	-0.87*
	- Decreasing ratio of mechanical eating score	-0.79
Increasing ratio of protein in milled rice	- Decreasing ratio of peak viscosity	0.80*
	- Decreasing ratio of consistency viscosity	-0.87*
Increasing ratio of amylose in brown rice	- Increasing ratio of fatty acid in brown rice	0.90*
	- Decreasing ratio of peak viscosity	0.83*
	- Decreasing ratio of hot viscosity	0.83*
	- Decreasing ratio of cool viscosity	0.83*
	- Decreasing ratio of consistency viscosity	-0.89*

*, ** : Significant at 5% and 1% level, respectively.