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Original Article

Cooking characteristics and sensory qualities of cooked rice (oryza sativa L. var NSIC rc218) as influenced by water and fertilizer applications

Ulysses A. Cagasan[1], and Jocelyn G. Daclag[2]

[1]Department of Agronomy, Visayas state university, Visca, Baybay City, Leyte 6521-A, Philippines
[2]Department of food Science and Technology, Visayas State University, Visca Baybay City, Leyte 6521-A, Philippines

ABSTRACT

Cultural practices such as fertilizer and water applications affect the amylose and protein contents of grains in rice which in turn influence the aroma and flavor of the cooked rice. This study aimed to (1) assess the cooking characteristics of lowland rice NSIC Rc218 as influenced by water and fertilizer applications; (2) assess the sensory qualities of lowland rice NSIC Rc218 as influenced by water and fertilizer applications and (3) determine the interaction effects of water and fertilizer applications in all growth parameters studied. Results of the study found that volume expansion ratio (VER) and water uptake (WU) of NSIC Rc218 cooked rice had significantly (p<0.05) higher when rice plants were planted in flooded conditions and applied with vermicast at 10 t ha^{-1}. Elongation ratio (ER) was significantly (p<0.05) higher (3.26) under flooded condition regardless of fertilizer applied. Sensory ratings for color, aroma, tenderness, and general acceptability of cooked NSIC Rc218 rice were significantly (p<0.05) enhanced when rice plants were subjected to AWD conditions and applied with vermicast alone at 10 t ha^{-1} or without fertilizer application. Moreover, only volume expansion ratio (VER) and water uptake (WU) of NSIC Rc218 cooked rice had a significant (p<0.05) interaction effects on water and fertilizer applications.

KEYWORDS: *AWD water management, cooking characteristics, fertilizer applications, sensory attributes*

1 INTRODUCTION

Efforts to study the effects of different cultural management practices on cooking characteristics and sensory qualities of cooked rice had been done by many researchers throughout the Philippines. However, few researches studied on the effects of water and fertilizer applications on the quality and sensory attributes of rice that had been documented and published (Cagasan and Tamayo, 2016). Some documented studies are the stability of the aroma content of lowland rice subjected to various cultural management practices. According to Arai and Itani (2000) stated that aroma and flavor content of rice decreases with time of storage and harvest maturity. They found out that the best flavor retained in the grains after cooking when the rice plants are harvested 20 days after 100% flowering. Moreover, they added that when rice was harvested 10 days before the ordinary time of harvesting (42 days after heading), the cooked rice was sweeter and more "delicious." They also found that flavor will decrease when rice plants were harvested late or over matured. Likewise, the amount of free amino acids in the exterior of cooked rice declined continuously with maturation.

On the other hand, environment, fertilization, and cultural practices affect the amylose and protein content of rice cultivars which in turn may influence the aroma and flavor of the cooked rice. Concentration of 2AP varies with environmental conditions. The 2AP concentration was higher in brown rice ripened at a low temperature (day 25^0C; night 20^0C) than that ripened at a high temperature (day 35 ^{0}C; night 30^0C) in both short and long-grain cultivars (IRRI 2012).

Moreover, research findings of Terao et al. (2005) showed that growing rice cultivar under elevated CO2 concentration decreased the protein content but did not change sensory properties to a level that could be detected by taste panel evaluation. Low protein rice was reported to be more flavorful compared to those with higher protein. This observation was corroborated by the descriptive sensory panels who found rice with lower protein content to have higher levels of desirable sweet aroma/taste attributes.

Champagne et al. (2007) reported that the aroma of milled rice differs with the degree of milling. Four types of rice milled in different degrees (92, 85, 75, and 50% milled rice) were subjected to odor evaluation. Significant differences in odor of cooked rice and in quantity of volatile components between 92% milled rice and 85, 75, and 50% of milling were observed. Higher concentrations of lipid oxidation products in the 92% milled rice compared with levels in deeper milled rice was probably because these products were contained in residual bran on the surface of the 92% milled rice.

*corresponding author: ulycagasan@vsu.edu.ph
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Likewise, they found out that there was an effect on the degree of milling on the flavor attributes moisture content and cultivar of cooked rice. Thus, this study was conducted to assess the cooking characteristics and sensory qualities of NSIC Rc218 as influenced by water and fertilizer applications and determine the interaction effects between water and fertilizer applications in all studied parameters.

2 MATERIALS AND METHODS

Cooking Characteristics

These parameters were evaluated at Food Chemistry Laboratory of PhilRice in Maligaya, Science City of Monoz, and Nueva Ecija.

1. Volume Expansion Ratio (VER) and Elongation Ratio (ER) - Volume expansion ratio and elongation ratio were determined using 15 ml of water placed in 50 ml graduated centrifuge tubes and 5 g of rice sample was added. Initial volume increase was measured (Y) and soaked for 10 min. Then, increase in volume before cooking was noted (Y-15). Then the cooked rice was placed in 50 ml water taken in 100 ml measuring cylinder and increase in volume of cooked rice in 50 ml of water was measured (X). Then the volume raise was recorded (X-50). VER and ER were calculated based on the guidelines established by Bhonsle and Krishnan, 2010.

2. Water Uptake.

Water uptake was determined using 2 g of samples placed in graduated test tubes with 10 ml of water and soaked for 30 min. As control, 10 ml of water was taken in two to three test tubes. All the test tubes were kept in water-bath for 45 min at 77 to 80 °C. After cooling, the supernatant of the samples was poured into graduated measuring cylinder and water level was noted. Similarly control water was measured. Then water uptake was calculated as 100/2 g actual water absorbed (Bhonsle and Krishnan, 2010).

Sensory Quality Evaluation

These parameters were done at the Department of Food Science, Visayas State University, Visca, Baybay City, and Leyte.

Grains harvested from the study were subjected immediately to different tests of sensory quality. Grain samples for evaluation were sundried until the grains reached 14% moisture content before milling. These were cooked and evaluated by the trained panelists while still hot. Criteria for the sensory quality evaluation were the following; color (whiteness), taste, aroma, tenderness by touching, tenderness by chewing and general acceptability.

Score sheets were provided to the thirty (30) trained panelists. Each judge/panelist has to rate the sensory quality of only six (6) samples a day. Approximately 100 g of cooked rice samples per treatment was placed in plastic cups which were randomly coded with three-digit number.

Sensory attributes were evaluated using quality scoring as perceived by the panelists in combination with five description scale for the sensory qualities. Scores were ranked from highest (5) to lowest (1) as the range of product descriptions. Higher scores mean the more preferred were the samples. General acceptability of the samples followed the hedonic scale of 1-9 (1 is the least and 9 is the highest) in terms of product acceptability.

Statistical Analysis

Data were statistically analyzed using the computer software Statistical Analysis System. Each parameter was analyzed using SAS 6.20 split-plot design while mean comparison at 5% level of significance was done using Honestly Significant Difference.

3 RESULTS AND DISCUSSION

Cooking Characteristics of NSIC Rc218

Cooking characteristics of lowland rice NSIC Rc218 variety were evaluated particularly on elongation ratio (ER), volume expansion ratio (VER) and water uptake (WU %) (Tables 1 to 3).

Elongation Ratio (ER)

Data on ER is presented in Table 1. Result revealed that only ER was significantly (p<0.05) influenced by water application while VER and WU were significantly (p<0.05) influenced by fertilizer applications.

Table 1. Elongation Ratio (ER) of NSIC Rc218 as influenced by water and fertilizer applications

Fertilizer Application	Water Application		Mean
	Flooded	AWD	
T_1 = No fertilizer (Control)	3.40	3.11	3.25
T_2= 100-60-60 kg ha^{-1} N, P_20_5, and K_20 (RRIF)	3.57	3.20	3.39
T_3= Vermicast 10 t ha^{-1} (RRVC)	3.41	2.89	3.15
T_4= 75% RRIF + 25% RRVC	2.90	2.98	2.94
T_5= 50% RRIF + 50% RRVC	3.06	3.00	3.03
T_6= 25% RRIF + 75% RRVC	2.92	3.03	2.97
Mean	3.26^x	3.01^y	

Means with the same letter in a row are not significantly different at 5% level, HSD

Grains of NSIC Rc218 after cooking revealed that ER was significantly (p<0.05) higher (3.26) under flooded condition compared to that of AWD condition (3.01), regardless of fertilizer applied. This result indicates that flooded condition in growing rice enhanced the length of cooked grains than the width resulting to high elonga

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ratio. Shahidullah et al. (2009) stated that higher elongation ratio (ER) of cooked rice was noted in rice grown under lowland condition. These results can be attributed to the presence of enough moisture to dissolve the nutrients and absorbed by the rice plants resulted in enhanced and developed filled grains.

Volume Expansion Ratio (VER)

Table 2 shows the direct relationship between volume expansion ratio and water uptake. A significant ($p<0.05$) interaction effect was noted in VER of cooked NSIC Rc218 as influenced by water and fertilizer applications. Results indicated that treatment applied with 10 t ha^{-1} vermicast showed significantly higher VER comparable to plants applied with 75% and 50% inorganic fertilizer RRIF under AWD condition. NSIC Rc218 milled rice when cooked absorbs water to compensate volumetric expansion of cooked rice. It can be noted that with increasing water uptake capacity, volumetric expansion is also increased. These results further suggested that VER of rice is not solely dependent on cultural practices and variety but also on the amount of water used during cooking. Bhonsle and Krishnana (2010) added that VER of rice during cooking depends also on the variety and percent (%) water uptake. Also, the study of (Tejada and Gonzales, 2008) on the application of vermicompost on rice crop showed positive effect on yield performance as well as grain quality and resulted to increased VER.

Table 2. Interaction effect on volume expansion ratio of NSIC Rc218 as influenced by water and fertilizer applications

Fertilizer Application	Water Application		Mean
	Flooded	AWD	
T_1 = No fertilizer (Control)	3.65^{b}	3.33^{bc}	3.49^{b}
T_2 = 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF)	3.72^{b}	3.87^{b}	3.79^{b}
T_3 = Vermicast 10 t ha^{-1} (RRVC)	4.50^{a}	4.02^{ab}	4.26^{a}
T_4 = 75% RRIF + 25% RRVC	4.15^{ab}	3.68^{b}	3.91^{ab}
T_5 = 50% RRIF + 50% RRVC	4.12^{ab}	3.84^{b}	3.98^{ab}
T_6 = 25% RRIF + 75% RRVC	3.59^{b}	3.79^{b}	3.69^{b}
Mean	3.90	3.87	

Means with the same letter in a column and rows are not significantly different at 5% level, HSD

The least VER was noted on treatments without fertilization comparable to plants applied with full inorganic fertilizer as well as plants applied with 50% and 75% inorganic fertilizer. Furthermore, Shahidullah et al. (2009) stated that the VER of aromatic rice varieties ranged from 2.50-4.50. Data show the direct relationship between water uptake and volume expansion ratio. It can be noted that with increasing water uptake capacity, volumetric expansion is also increased.

Water Uptake (WU)

NSIC Rc218 when cooked absorbs water to compensate volumetric expansion and increase in kernel length of cooked rice (Table 3). Data show direct relationship between water uptake and volume expansion ratio. It can be noted that with increasing water uptake capacity, volumetric expansion is also increased. A significant ($p<0.05$) interaction effect was noted on % WU when the plants were subjected in water and fertilizer applications and applied with pure verrmicast at 10 t ha^{-1} showed the highest

Table 3. Interaction effect on water uptake (%) of NSIC Rc218 rice as influenced by water and fertilizer applications

Fertilizer Application	Water Application		Mean
	Flooded	AWD	
T_1 = No fertilizer (Control)	371^{b}	370^{b}	370^{b}
T_2 = 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF)	373^{b}	386^{b}	379^{b}
T_3 = Vermicast 10 t ha^{-1} (RRVC)	400^{a}	411^{a}	405^{a}
T_4 = 75% RRIF + 25% RRVC	381^{b}	386^{b}	383^{ab}
T_5 = 50% RRIF + 50% RRVC	385^{b}	381^{b}	383^{ab}
T_6 = 25% RRIF + 75% RRVC	395^{b}	366^{bc}	381^{ab}
Mean	384	385	

Means with the same letter in a column and row are not significantly different at 5% level, HSD

WU (400% and 411%, respectively) in cooked rice regardless of conditions (flooded and AWD). This was followed by other treatments without fertilization, 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF), 75% RRIF + 25% RRVC, 50% RRIF + 25% RRVC and 25% RRIF + 75% RRVC regardless of growing conditions, (flooded and AWD). This result conforms the statement of Javier et al. (2006) that vermicast fertilizer contains not only macronutrients but also essential micronutrients like Sodium (Na), Calcium (Ca), Zinc (Zn), Sulphur (S), Magnesium (Mg) and Iron (Fe), which are needed by the plant to complete its life cycle. Hence, resulted to improved quality of rice grains, thus, absorption of moisture (% WU) between the grains during cooking was significantly ($p<0.05$) enhanced. Moreover, Tan et al. (2000) stated that % WU during cooking process is associated with appearance of cooked rice.

The least % WU was noted on plants without fertilizer application, comparable to other treatments except on treatment applied with pure vermicast at 10 t ha^{-1}. However, all values in % WU, in this study, were classified as high regardless of conditions. Morec Javier et al. (2006), stated that organic fertilizer 71 improve quality of rice grains, thus, absorption oı moisture between grains during cooking was

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significantly ($p<0.05$) enhanced resulting to higher % WU during cooking.

Sensory Qualities of Cooked Rice NSIC Rc218

Sensory attributes, extremely important traits that dictate marketability of the products, thus, affect the return and profitability of rice growers (Clumpett et al., 2004) as cited by Ratilla (2011).

Data on sensory quality evaluation of freshly milled cooked NSIC Rc218 are presented on Tables 4 to 8. Among the sensory parameters evaluated, only color, aroma, tenderness and general acceptability were significantly affected by water and fertilizer applications. Other sensory parameter like taste was not significantly ($p<0.05$) affected by differed treatments but ratings ranged above three and classified as tasty. No significant interaction was noted in sensory parameters as influenced by water and fertilizer applications.

favorable enhancement of aroma on cooked rice samples. According to Champagne et al. (2008), AWD cultured plants enhanced the availability of chemical compound responsible for aroma due to stress conditions.

Moreover, Ratilla and Cagasan (2011) stated that lowland rice subjected to water stress produced grains with low % MC when sundried and will not change significantly ($p<0.05$) its physiological characteristics in terms of grain components, thus, resulting to quality grains. Playing a role in the aroma of rice, amount of free amino acids in the exterior of cooked rice declined continuously with maturation. Flavor was considered to be rich in immature rice but poor in over ripened rice. Moreover, Champagne et al. (1997) reported that there was significant difference in odor of cooked rice and in quantity of volatile components when rice is grown in stress drought condition.

Table 4. Aroma of cooked NSIC Rc218 as influenced water and fertilizer applications

Fertilizer Application	Water Application		Mean	Description
	Flooded	AWD		
T_1 = No fertilizer (Control)	2.90	3.30	3.10	Aromatic
T_2 = 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF)	3.00	3.30	3.25	Aromatic
T_3 = Vermicast 10 t ha^{-1} (RRVC)	3.20	3.40	3.30	Aromatic
T_4 = 75% RRIF + 25% RRVC	2.90	3.50	3.20	Aromatic
T_5 = 50% RRIF + 50% RRVC	2.80	3.45	3.13	Aromatic
T_6 = 25% RRIF + 75% RRVC	2.98	3.50	3.24	Aromatic
Mean	2.90^y	3.41^x		
Description	Slightly Aromatic	Aromatic		

Means with the same letter in a row are not significantly different at 5% level, HSD

Table 5. Color of freshly milled cooked NSIC Rc218 as influenced of water and fertilizer applications

Fertilizer Application	Water Application		Mean	Description
	Flooded	AWD		
T_1 = No fertilizer (Control)	2.90	3.00	2.95	SW
T_2 = 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF)	2.60	3.00	2.80	SW
T_3 = Vermicast 10 t ha^{-1} (RRVC)	3.20	3.40	3.30	W
T_4 = 75% RRIF + 25% RRVC	2.80	2.90	2.85	SW
T_5 = 50% RRIF + 50% RRVC	2.80	3.45	3.13	W
T_6 = 25% RRIF + 75% RRVC	2.98	3.10	3.04	W
Mean	2.83b	3.10a		
Description	SW	W		

Means with the same letter in a row are not significantly different at 5% level, HSD
SW-Slightly White, W-White

Aroma

Statistical analysis on aroma content of NSIC Rc218 is presented in Table 4. Results show a significantly ($p<0.05$) higher rating for samples under AWD condition (3.41) compared to flooded treatment plots (2.90) but not on fertilizer application. Limited water supply caused

However, treatments under different fertilizer applications were classified as aromatic, except 72 treatments grown under flooded condition. According to Quirino Dela Cruz (personal communication, 2/2 /2015), NSIC Rc218 possesses special characteristics on sensory characteristics, specifically on aroma and flavor compared to other rice varieties.

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Color

Statistical analysis revealed that there was significantly ($p<0.05$) higher rating on color, on the samples under AWD condition (3.10) compared to flooded treatment plots (2.83), (Table 5). However, no significant differences were noted on different treatments under fertilizer applications.

Limited water supply caused favorable enhancement on the whiteness color of grains as well as after cooking. Short storage period below room temperature is recommended to maintain rice quality. According to

Bhonsle and Krishnan (2010) rice grown under organic culture showed special sensory attributes because of growth promoting hormones from organic fertilizer that enhanced acceptability on sensory quality, particularly on color, flavor and aroma.

Tenderness by Chewing

Data on tenderness by chewing of NSIC Rc218 is presented in Table 6. Results show no significant ($p<0.05$) differences among treatments under two water applications (Flooded and AWD), but had on fertilizer

Table 6. Tenderness by chewing of cooked NSIC Rc218 as influenced by water and fertilizer applications.

Fertilizer Application	Water Application		Mean	Description
	Flooded	AWD		
T_1 = No fertilizer (Control)	3.00	3.50	3.25[a]	Tender
T_2= 100-60-60 kg ha^{-1} N, P_2O_5, and K_2O (RRIF)	3.30	2.80	2.85[b]	ST
T_3= Vermicast 10 t ha^{-1} (RRVC)	3.60	3.40	3.50[a]	Tender
T_4= 75% RRIF + 25% RRVC	2.80	2.90	2.85[b]	ST
T_5= 50% RRIF + 50% RRVC	2.80	3.45	3.13[ab]	Tender
T_6= 25% RRIF + 75% RRVC	2.98	3.10	3.04[ab]	Tender
Mean	3.13	3.20		
Description	Tender	Tender		

Means with the same letter in a column are not significantly different at 5% level, HSD
ST-Slightly Tender

Table 7. Tenderness by touching of freshly milled cooked NSIC Rc218 as influenced by water and fertilizer applications

Fertilizer Application	Water Application		Mean	Description
	Flooded	AWD		
T_1 = No fertilizer (Control)	3.00	3.55	3.28	Tender
T_2= 100-60-60 kg N, P_2O_5, and K_2O ha^{-1} (RRIF)	3.25	3.40	3.33	Tender
T_3= Vermicast 10 t ha^{-1} (RRVC)	3.30	3.40	3.35	Tender
T_4= 75% RRIF + 25% RRVC	3.30	3.50	3.40	Tender
T_5= 50% RRIF + 50% RRVC	3.30	3.50	3.40	Tender
T_6= 25% RRIF + 75% RRVC	3.00	3.45	3.23	Tender
Mean	3.19[y]	3.57[x]		
Description	Tender	Tender		

Means with the same letter in a row are not significantly different at 5% level, HSD

Champagne et al. (2005) rice planted in limited water condition produced quality grains leading to enhancement of color and aroma of lowland rice. On the other hand, no significant difference was noted on different treatments under fertilizer management system. However, treatment plants applied with vermicast 10 t ha^{-1} and 50% RRIF + 50% RRVC and 25% RRIF +25% RRVC showed whiter color of cooked rice compared to treatments applied with high level of inorganic fertilizer and treatments without fertilizer were classified as slightly white. According to

treatments. Moreover, no significant ($p<0.05$) interaction effect was observed on tenderness by chewing as influenced by water and fertilizer applications.

A significantly ($p<0.05$) higher rating on tenderness by chewing (3.50) was noted on treatments applied 73 pure vermicast at10 tha^{-1} comparable to treat without fertilizer application (3.25) and treatments with 50% and 75% RRVC (3.13-3.04). On the other hand, the least rating (2.85) was observed in treatment plants applied at rate of 100-60-60 kg N, P_2O_5, and K_2O ha^{-1} (RRIF) and 75% RRIF + 25% RRVC but comparable to

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treatments plants applied with 50% RRIF + 50% RRVC (3.13) and 25% RRIF + 75% RRVC (3.04). These results conformed to the statement of Yamota and Tan (2007) that organic fertilizer like vermicast increases the population of microbes that are known to help synthesize growth promoting hormones that enhance growth and yield production as well as the physicochemical attributes of crops.

In addition, other factor that affects rice grain quality is application of nitrogen fertilizer. Nitrogen application increases yield but reduces quality of grains, especially on aroma and flavor as noted in this study. Moreover, Chaturvedi (2005) mentioned that the type of nitrogenous fertilizer like synthetic chemicals may increase yield of rice but affect quality of grains, thus, lessen their general acceptability in terms of sensory qualities.

Tenderness by Touching

Likewise, tenderness by touching of NSIC Rc218 is presented in Table 7. Results show significantly (p<0.05) higher rating for samples under AWD condition (3.57) compared to flooded treatment plots (3.19). However, no significant difference was observed under fertilizer application as well as on interaction effect between water and fertilizer applications.

Yamota and Tan (2007) stated that lowland rice subjected to AWD production system, significantly improved its physiological characteristics in terms of grain quality components, thus, when cooked, resulted to tenderness and tastiness. This result further indicates that plant grown under AWD condition not only improves crop productivity but also enhances sensory attributes of cooked rice (Champagne et al., 2008).

Taste

Sensory taste of NSIC Rc218 is presented in Table 7. Result shows no significant (p<0.05) variation on taste of NSIC Rc218 with rice plants grown in different water 74 fertilizer applications. No significant (p<0.05) interaction effect was noted in sensory on taste between water and fertilizer applications.

However, all values on sensory taste in this study were classified as tasty, regardless of growing conditions (flooded and AWD) and different fertilizer applications. This result indicates that NSIC Rc218 variety possesses special characteristics, particularly sensory attributes and

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still observed even when grown under different environmental conditions, PhiRice (2011). However, these sensory characters are easily gone because these are volatile compounds that easily evaporate (Champagne et al., 2004).

General Acceptability

General acceptability of NSIC Rc218 was significantly increased by fertilizer applications and not by water application (Table 8). On the other hand, treatments applied with pure vermicast at 10 tha^{-1} significantly increased acceptability rating comparable to treatments applied with 50% RRIF + 50% RRVC and 25% RRIF + 75% RRVC. The least general acceptability of the samples was noted on the treatments applied with high amount of inorganic fertilizer 100-60-60 kg N, P_20_5 and K_20 ha^{-1} (RRIF) and 75% RRIF + 25% RRVC but comparable to 50% RRIF + 50% RRVC and 25% RRIF + 75% RRVC. This result correlates with the effect of Nitrogen application that affects quality of cooked rice due to increase in crude protein resulting to decrease in amylose content of cooked rice.

On the other hand, the effect of vermicast to the sensory attributes of cooked rice, indicated that vermicast contains chemical enzymes and micronutrients like Sodium (Na), Calcium (Ca), Zinc (Zn), Sulphur (S), Magnesium (Mg) and Iron (Fe) that enhance sensory attributes, particularly on aroma of NSIC Rc218 resulting in high general acceptability. Furthermore, Juliano (2008) mentioned that aroma and flavor have been considered as major criteria for the general acceptability of cooked rice.

4 CONLUSIONS

Based on the results of the study, conclusions can be drawn; Cooking characteristics such as volume expansion ratio (VER) and water uptake (WU) were significantly (p<0.05) increased when applied with vermicast at 10 t ha^{-1} and had interaction effects on water and fertilizer applications. Elongation ratio (ER) was significantly (p<0.05) increased under flooded condition regardless of fertilizer applied.

Sensory ratings on color, aroma and tenderness by touching of freshly milled cooked rice NSIC Rc218 were significantly (p<0.05) higher in treatments subjected to AWD condition. Tenderness by chewing and general acceptability were significantly (p<0.05) enhanced when plants were applied with pure vermicast at 10 t ha^{-}

There was a significant interaction effect on volume expansion ratio (VER) and water uptake (WU) of NSIC Rc218 as influenced by water and fertilizer applications.

RECOMMENDATION

To further evaluate the effects of water application on the cooking characteristics and sensory qualities of NSIC Rc218, this study is recommended to be conducted in areas where dry season is very pronounced like in the province of Nueva Ecija.

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