Journal of Agriculture and Technology Management (JATM)
26(2): (July-December 2023)
Article ID: 10010 | Received: 09-20-2022 Revised: 11-21-2022 Accepted: 06-25-2023

Original article

Performance of lowland rice (*Oryza sativa* L. var. NSIC Rc216) from different seed quality planting materials

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ABSTRACT

Seed quality is one of the critical considerations in crop production. However, most farmers did not observe the importance of rice quality and seed preparation as planting materials. This study aimed to determine the effects of seed quality (lighter and heavy seeds) on germination, growth, and yield performance of NSIC Rc216 as planting materials. The experiment was laid out in complete randomized design (CRD) with three replications. The treatments are as follows: T_1–randomly taken from the seeds stock (check), T_2- Floater/Light Seeds, and T_3 – Sinker/Heavy Seeds. Results revealed that heavy seeds significantly ($p<0.05$) gave higher % germination and vigor. However, heavy seeds were comparable to the control treatment (not tested for floatation) in terms of plant height (cm), fresh weight of seedling, number of productive tillers, days to maturity and percent germination, the weight of 1000 seeds g hill-1 and total grain yield tha^{-1}. However, lighter half-filled seeds showed a very inferior performance to the other treatments.

KEYWORDS: *NSIC Rc216 rice variety, Floatation method, Planting Materials, Yield Performance, Seed quality*

1 INTRODUCTION

Rice (*Oryza sativa* L.) is a significant staple food among Filipinos. It produces more food calories than any other crop. According to FAO (2017) the global rice consumption has exceeded 550 per capita daily calories. The world's population continues to grow to an estimated 10 billion by 2050. The demand for rice will grow faster than the other crops because population growth is most significant in the rice-consuming and rice-producing regions of Asia, Africa, and the Americas (Vandevelde et al., 2018). In recent years, rice stocks have fallen dramatically due to low production and supply of rice at the lowest level within the 10 year period (Hay et al. 2018). A critical factor affecting rice production is the proper cultural management practices and the selection of quality variety and healthy planting materials. Thus, high-quality seeds with high percent germination and vigor are recommended. Seed quality is significant in direct-seeded rice or transplanting as planting materials. Likewise, seed size and weight, are essential characteristics associated with seedling germination, vigor, crop stand, and grain yield (Bewley et al., 2013). However, some farmers used low-quality seeds due to the expensive certified seeds. They resort to use even half-filled seeds because they did prepare the seeds ahead of time. To verify this farmer's practice, the relationship of physical traits such as seed quality to seedling germination and vigor and agronomic performance of rice will be studied. Thus, this study was conducted to determine the effects of seed quality on the germination, growth, and yield of NSIC Rc216 rice variety.

2 MATERIALS AND METHODS

Rice seeds (NSIC Rc216 variety), a farmer's seed stock, were selected and used for the study. The following treatments were designated: T_1- not subjected for floatation (Control taken from the farmer`s seed stock), T_2- Floater/Light Seeds, and T_3- Sinker/Heavy Seeds. For the control treatment, a few seeds were randomly taken from the stock and not subjected to floatation. The floatation method was done by immersing the seeds in a pail almost filled with water. This method was done to separate the heavy and the lighter seeds. Seeds that sank to the bottom of the basin were considered heavy seeds and were used for the treatment (T_3). Seeds settled from the middle to upper surface of the pail were considered lighter seeds and were used for treatment (T_2). To facilitate operation and management, the experimental treatments were randomly arranged at a distance of 30 cm between pots. The experiment was arranged in Complete Randomized Design (CRD) with three replications. Fifty-two (52) randomly collected seeds from the three (3) sample treatments (T_1- Control, T_2- Floater/light seeds, and T_3- Sinker/heavy seeds) were sown in each container

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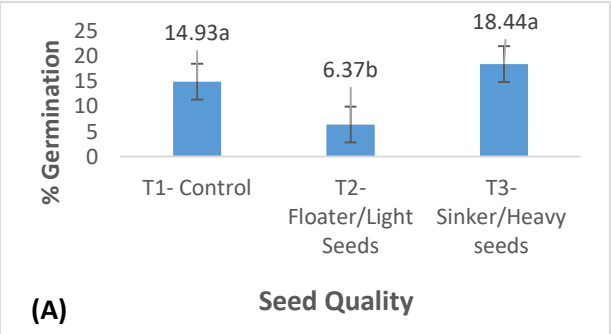
p-ISSN: 2599-4875 e-ISSN: 2599-4980

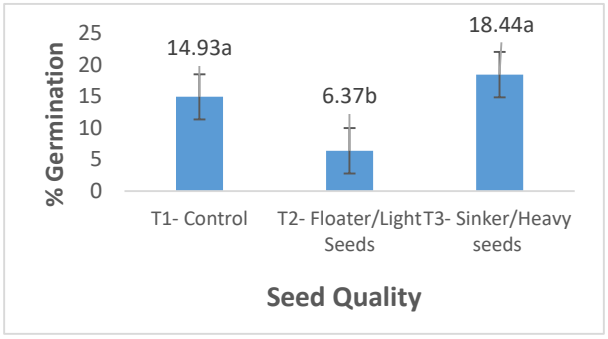
for germination. Water was provided and maintained in the container to ensure the development of germinating seeds. Eighteen (18) pots (using a small pails) were prepared with 10kg clay soils taken from the rice field. There were two (2) treatment pots used in every treatment per replication. The Uniform distance of seeds in each pot was observed to ensure uniform growth of the seedlings. Thirty (30) days after sowing, data on percent (%) germination, plant height (cm), and weight of seedling (g) were gathered. This was done by uprooting 50 seedlings per pot, leaving two seedlings in each pot for the data on the growth and yield parameters. The 50 seedlings uprooted were used to gather the percent germination, plant height (cm), and fresh weight (g). Application of complete fertilizer (14-14-14) was made 5 grams per pot five days after planting. The fertilizer was evenly distributed in each pot and ensuring the availability moisture in the soil until maturity. Cleaning of the environment was also maintained to control the entry of some pests into the neighboring areas. Proper cultural management practices were employed in the pot experiment until the study was harvested and terminated.

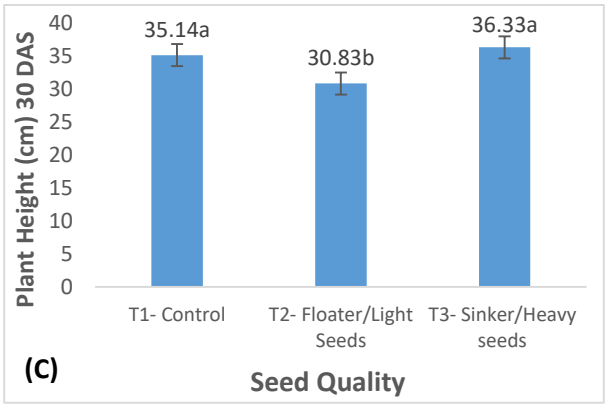
Data Gathered and Analysis

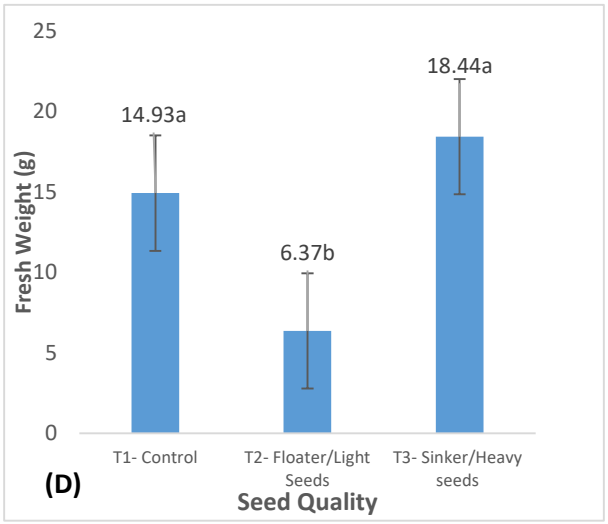
The following parameters were evaluated for seedling performance such as percent (%) germination, plant height (cm) after 10 and 20 days from sowing, and fresh weight (g) of seedling after 30 days from sowing. For agronomic characteristics: number of tillers per hill/pot, number of productive tillers per hill/pot, plant height at maturity (cm), and number of days from planting to maturity. For yield and yield components: length of panicle (cm), number of filled grains panicle^{-1}, the weight of 1000 seeds (g), grain yield (g) per pot, and total grain yield (tha^{-1}). All data were analyzed using the Statistical Tool for Agricultural Research (STAR) for the analysis of variance (ANOVA). The comparison of treatment means was subjected to the Honestly Significant Difference (HSD) Test at 5% level of significance.

3 RESULTS AND DISCUSSIONS









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

Figure 1. Germination performance (A) plant height of 10 DAS (cm), (B) plant height of 30 DAS, and (C) fresh weight (g) of rice is affected by the seed quality for planting materials

Treatment (T_3) heavy seeds significantly comparable to (T_1) control in all the parameters studied. However, (T_2) lighter seeds were significantly lower in percent germination, plant height (cm), and fresh weight (g) at 30 days after sowing, (Figure 1). This result showed the advantages of the heavy seeds, which are characterized by

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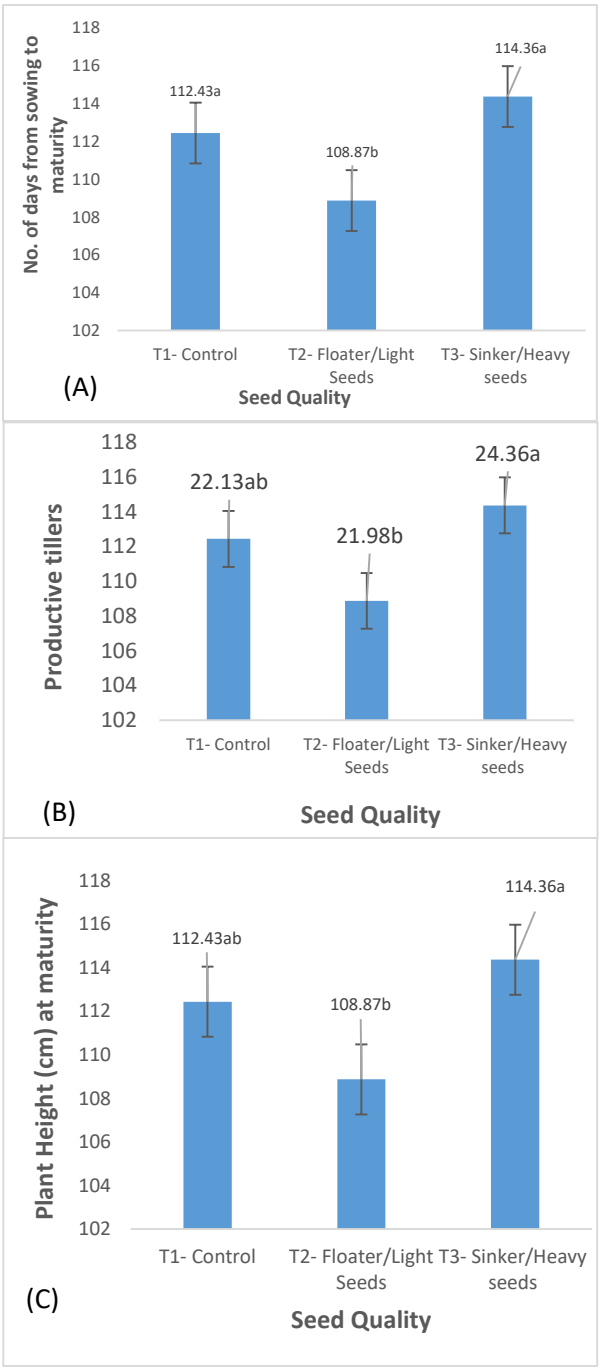
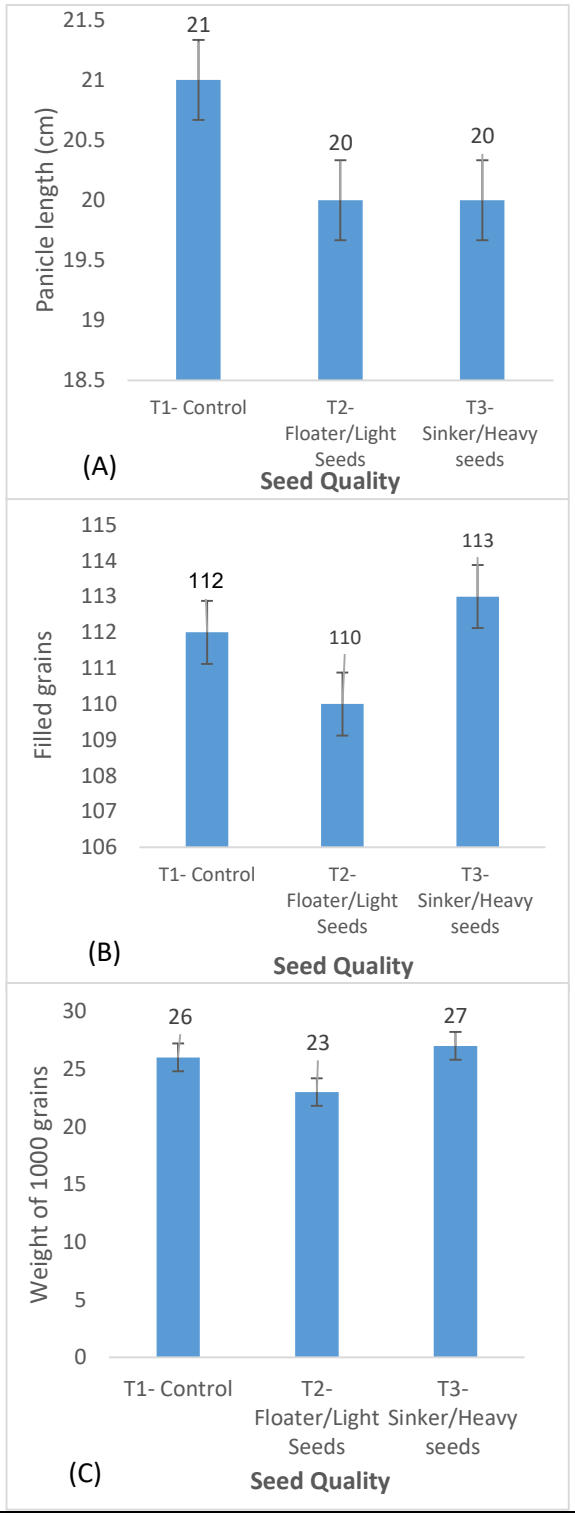
complete enzymatic elements inside the seeds, such as the planting materials are presented in Figure 3. These treatments (T_3 and T_1) significantly produced a heavier weight of 1,000 seeds and contributed to the increase in total grain yield (tha^{-1}). Heavy/sinker seeds (T_3) full of enzymatic enzymes, obtained a higher weight of 1000 seeds and resulted in to increase in the total yield (tha^{-1}). However, it was comparable to T_1 (control not subjected



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

Figure 2. Agronomic characteristics of NSIC Rc216 rice variety as influenced by seed quality for planting materials

On the other hand, the yield characteristics of NSIC Rc216 rice variety as influenced by seed quality for



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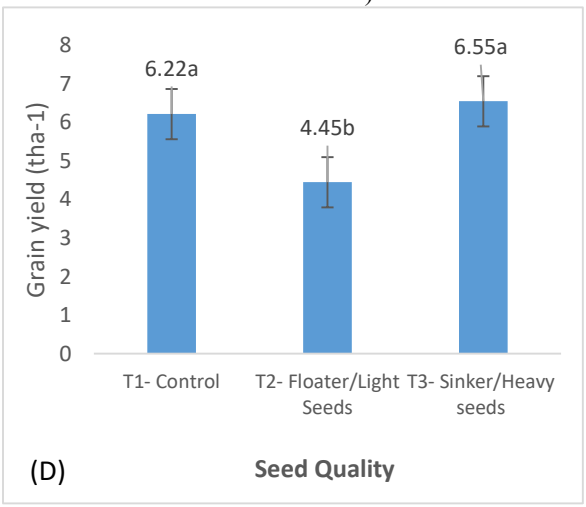
to floatation as farmer`s seeds stock).



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

Figure 3. Yield characteristics of NSIC Rc216 rice variety as influenced by seed quality for planting materials

This result further suggested that good quality seeds will give an excellent agronomic performance and resulted to a heavier weight of 1000 seeds (g) and the total yield (tha^{-1}). (IRRI, 2013) reported that seed vigor is an important factor that often results in good seedling establishment. On the other hand, seeds low in vigor generally produce weak seedlings susceptible to environmental stresses. Whereas seed quality has a high level of vigor in seeds can be expected to provide for early and uniform stands, which give the growing seedlings a competitive advantage against various environmental stresses (Mickelbart, et al., 2015).

4 CONCLUSION

Based on the result of the study, it was found that seeds not subjected to floatation as the control treatment and heavy/sinker seeds significantly showed comparable good performance in terms of germination, agronomic, yield, and yield components parameters of NSIC Rc216 rice variety. Hence, it is concluded that the practice of the farmers of utilizing low-quality seeds the unfilled seeds are not recommended for use as seeds because of the very low performance in all parameters studied.

RECOMMENDATION

A follow-up study may be conducted by adding other factors like fertilizer levels to evaluate further the effects of the different quality of seeds for planting materials. Also, floater seeds (half-filled) will be removed as they gave very low germination and growth performance in the field. It is also recommended to conduct this kind of study in the rice field to verify the results in the pot experiment.

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