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Research Note

Evaluation of AV-5055 as Seed Dresser in Lowland Rice Production

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Abstract
This experiment was established in 2020 cropping season at National Cereals Research Institute experimental field at Badeggi in Guinea Savannah agro-ecological Zone, (Latitude 9 04^0 Longitude 6 07^0 E), to assess seed dressing effect of AV-5055 on rice seed. The experiment was laid out in Randomized Complete Block Designs (RCBD), replicated three times. It consisted of four (4) treatments: application of AV-5055 rate at 0.7L, 1.2L, 1.7L per 100kg of rice seed and no application of chemical as (control). Data was taken on plant height, tiller count, days to 50% flowering, bird damage, rodent damage panicle per meter square and grain yield. The result shows that there was no significant difference ($P > 0.05$) in plant height, tiller count, days to 50% flowering and bird damage. However, control plot had significantly ($P < 0.05$) lower rodent damage (0.00) and higher grain yield (2060.00kg/ha) compared to rodent damage and grain yield in treated plots (0.33-2.33) and (1789.00-1999.03) respectively. It was concluded from the result of analysis that AV-5055 offer protection to dressed seed against bird depredation from planted field as there was no significant difference on bird depredation among the various rates of AV-5055 application. However, various rates of AV-5055 application attract picking by rodents and subsequent reduction on yield. Thus it was recommended that AV-5055 should be applied in combination with rodenticides to give perfect seed protection against birds and rodents.

Keywords: *Oryza sativa, AV-5055, anthraquinone, Quelea quelea, Repellent*

Introduction

Rice (*Oryza Sativa*) is a staple food in many countries of Africa and other parts of the world. It is classified as the most important food depended on by over 50% of the world population for about 80% of their food need (Udemezue, 2014). Sequel to the growing importance of the crop, Food and Agricultural Organization (FAO) of the United Nations estimated that annual rice production should be increased from 586 million metric tons in 2000 to meet the projected global demand of about 756 million metric tons by 2030 (FAO, 2000; Udemezue, 2014). West Africa accounted for 64.2% and 61.9% of total rice production and consumption in sub-Saharan Africa. In west Africa, Nigeria ranks highest as both the producer and consumer of rice in the sub-region (Imolehin and Wada, 2000). Despite rice becoming an important cereal and staple food crop, its production in Africa is still the lowest in the world and cannot meet the increasing demand for rice in many African countries (Hossain, 2006). This is as a result of many factors as soil, seed, changing climate, diseases and pests especially birds (Misari, 2002). Planted rice seed and the ripening rice crop is prone to heavy damage from birds and rodents, a primary agricultural pest in rice growing regions (Linz *et al*., 2017). Birds like Blackbirds can cause significant levels of damage to the rice crop, both at seeding and as the crop approaches harvest maturity. Several species of blackbirds are responsible for damage to rice crops, particularly red-winged blackbirds (*Agelaius phoeniceus*), common grackles (*Quiscalus quiscula*) and brown-headed cowbirds (*Molothrus ater*) (Linz *et al*., 2011). Continuous avian pest damage may be financially taxing to individual agricultural

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operations, and thus producers require cost-effective management strategies to combat avian crop depredation (Hulke and Kleingartner, 2014). Various management strategies have been considered to reduce bird damage to crops including lethal control, chemical repellents, physical frightening devices (e.g. propane cannons and unmanned aircraft systems), evading strategies (e.g. decoy crops), and habitat management (e.g. cattail management) (Hagy *et al*., 2008; Werner *et al*., 2008; Linz and Homan, 2011; Linz *et al*., 2011). Current management methods suffer from a combination of limited extent of effectiveness in space and time, negative cost-benefit ratios, or the habituation of birds to the tool (Gilsdorf *et al*., 2002; Klug, 2017). For example, lethal control has not been deemed cost-effective due to large population sizes, high population turnover rates, and extreme mobility of blackbirds (Blackwell *et al*., 2003; Linz *et al*., 2015). Nonlethal chemical repellents hold the potential to be a cost-effective management tool for broad scale agriculture provided application difficulties can be overcome and alternative food is available for foraging birds (Klug, 2017). Chemicals containing Anthraquinone (AQ) deters birds especially blackbirds from feeding on treated food (e.g., rice achenes) in cage and pen trials (Avery *et al*. 1997; Werner *et al*., 2009 & 2011) and in small plot field trials (Avery *et al*., 1998; Werner *et al*., 2015). Anthraquinone is a secondary repellent, which has been shown to cause distress after ingestion, sometimes leading to vomiting (Avery *et al*., 1997). Anthraquinone is currently registered by United States Environmental Protection Agency (USEPA) to repel Canada geese (*Branta canadensis*) from grass and turf (Flight Control™) and as a seed treatment (Avipel™) for protecting planted seed from birds (Avery, 2003). Brown *et al. (2017)* had earlier observed that rodents may damage rice at all stages, from sowing through to ripening and harvest, hence, in protecting planted seed from birds, the possibility of rodent attack also should not be overlooked. The authors further buttress that after sowing, rodents can consume the entire seed or seedling, which leads to the complete removal of a plant leading to yield penalty. Thus evaluation of AV 5055 to manage birds that can cause total crop damage during reproductive stage of rice production is worthwhile. The aim of the study was to evaluate the efficacy of AV-5055 as rice seed dresser against rodent and bird on rice (*Oryza sativa*) production.

Materials and Method

This experiment was carried out in 2020 wet and dry cropping seasons at rice experimental field of the National Cereals Research Institute Badeggi in Guinea Savanna agro-ecological zone, (Latitude 9 04^0 Longitude 6 07^0 E). The experiment was laid out in Randomized Complete Block Designs (RCBD) and replicated 3 times. The trial consisted of Four (4) treatments: application of AV-5055 at rate of 0.7L, 1.2L and 1.7L per 100kg of rice seed and No application (control). AV-5055 is pesticide formulation for the protection of rice against consumption by birds. It has 18% of an active ingredient of 9,10-Anthraquinone with liquid flowable formulation. The use of AV-5055 in agricultural application is protected by international patents. The treated seeds were direct seeded using dibbling method of planting at 20 cm x 20 cm inter and intra plant spacing. Fertilizer was applied at the rate of 40 kg ha of N, P_2O_5 AND K_2O using NPK (15:15:15) as basal dressing while additional 40kg/ha of N was applied at three weeks after seeding. Weeding was done manually at 21 and 40 days after planting. Data was collected on the following parameters: Number of tiller: Plant height (cm), Number of days to 50 % flowering, Panicle/m2, Birds incidence, Rodent incidence and Grain yield. Collected data was subjected to analyses of variance (ANOVA). The significant means were separated using Least Significant Difference (LSD).

Results and Discussion

There was no significant difference (at $P > 0.05$) on the plant height at maturity among rice plots treated with the three levels of AV-5055 and the control (Table 1). Also, Number of days to 50% flowering was not affected by the various treatments as the result shows no significant difference ($P > 0.05$), (Table 1). Uniformity in plant height and attainment of 50% flowering shown in (table 1), suggested that application of AV-5055 did not have influence on rice height and attainment of 50% flowering, it only serve as repellant against birds and does not have growth inducement properties thus the FARO 44 used, only exhibited their inherent height and days to 50 % flowering trait. There was significant difference (P > 0.05) on the number of tiller per hill of rice at maturity among the four treatments. The control plot had significantly higher tiller count compared to tiller count of plots treated with three levels of AV-5055 (Table 1). There was no incidence of bird damage among plots of rice treated with AV-5055 at rate of 0.75L, 1.2L and 1.7L per 100kg of rice seed and the control plots (Table 2). The zero damage to all rice plots treated with AV-5055 with active ingredient (ai) Anthraquinone, proved the efficacy of AV-5055 as a good seed dresser against bird pest during planting. This is in line with earlier finding of (Avery, 2003) who stated that Anthraquinone is currently registered by United States Environmental Protection Agency (USEPA) as a seed treatment (Avipel) for protecting planted seed from birds. There was significant difference (P < 0.05) among the four treatments on rodent damage incidence after planting during the wet season. Rice plots treated with highest rate, AV-5055, 1.7 L / 100kg of rice seed and AV5055 applied at rate of 1.2 L / 100kg of rice seed had highest rodent damage incidence in wet season. The lowest incidence was recorded on the control plots in both seasons. However, in dry season there was no significant difference of rodent damage among the four treatments evaluated (Table 2). Lower rodent damage in control plots compared to treated plots suggested that seeds treated with AV-5055 attracted rodent and subsequent damage. The Rice panicle production was significantly different among plots treated with varied levels of AV-5055. The control plot had highest panicle per meter square while the plot treated with highest dose, AV-5055 at rate of 1.7L/100kg of rice seed had the lowest panicle per meter square. Higher panicle per meter square observed in control plot may be due to lower rodent damage incidence in control plots. There was significant variation of grain yield among varied rates of AV-5055 applied to seed. Controlled plots had significantly higher yield compared to grain yield obtained in plots treated with varied rates of AV-5055. The lowest yield was gotten from plot treated with AV-5055 at rate of 1.7L/H (Table 2). The resultant higher yield in control plots may be attributed to higher tiller count and higher panicle per meter square because of lower incidence of rodent damage on the control plots. This is conformity with findings of (Mulungu, 2014) who observed that rodent digging up and eating of planted rice seeds in the direct seeded fields ultimately results in lower yields. Moreso, rodents are considered among the world's most important pests (Prakash, 1988; Buckle and Smith, 2015), causing substantial damage to rice production globally (Elias and Fall, 1988; Hoque *et al*. 1988; Marsh, 1988; Singleton, 2003; Singleton *et al*., 2010).

Conclusion

It was concluded from the result of analysis that AV-5055 offer protection to dressed seed against bird depredation from planted field as there was no significant difference on bird depredation among the various rates of AV-5055 application. However, various rates of AV-5055 application attract picking by rodents and subsequent reduction on yield. Thus it was recommended that AV-5055 should be applied in combination with rodenticides to give perfect seed protection against birds and rodents.

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Table 1: Rice tiller count, plant height and days to 50 % flowering as affected by application of AV-5055 in 2020

Treatments	**Tiller count**		**Plant height**		**Days to 50% flowering**	
	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season
AV5055 0.7L/100kg	17.00	19.00	76.53	72.63	87.00	85.00
AV5055 1.2L/100kg	16.66	19.33	77.30	72.83	87.33	85.00
AV5055 1.7L/100kg	17.00	19.33	76.70	73.43	87.00	85.33
Control	19.00	19.00	77.60	72.77	87.00	85.00
LSD	**1.7**	NS	**NS**	NS	**NS**	NS
CV%	4.4.5	0.97	19.50	0.91	0.90	0.46

NS= Not Significant, LSD= Least Significant Difference

Table 2: bird damage incidence, rodent damage incidence panicle per m2 and grain yield as affected by application of AV-5055 in 2020

Treatments	**Birds incidence**		**Rodent incidence**		**Panicle/m2**		**Grain yield**	
	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season
AV5055@0.7L/100kg	0.00	0.00	0.66	0.33	258.67	269.67	1999.03	2217.60
AV5055@1.2L/100kg	0.00	0.00	1.67	0.33	251.66	271.00	1868.00	2300.00
AV5055@1.7L/100kg	0.00	0.00	2.33	0.33	245.33	270.00	1789.00	2274.53
Control	0.33	0.00	0.00	0.00	268.66	270.00	2060.00	2255.30
LSD	**NS**	**NS**	**1.94***	**NS**	**22.00**	**NS**	**57.26***	**NS**
CV%	30.4	1.00	24.5	0.80	0.7	20	1.5	0.11

NS= Not Significant, LSD= Least Significant Difference,*= significant