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EFFECTS OF NEW HIGH-YIELDING VARIETIES AND FERTILIZER DOSES ON THE GROWTH AND YIELD OF UPLAND RICE CROPS ON DRY LAND IN MALUKU, INDONESIA

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Abstract:

The purpose of the study was to determine the effect of varieties and fertilizer doses on the growth and production of upland rice on dry land in Maluku. The study used a Split Plot Design with 25 treatment combinations and three repetitions. The treatment consists of the Main Plot, a new high-yielding variety, consisting of five levels, namely Inpago 8; Inpago 11; Inpago 12; Rindang 1 and Rintang 2, and subplot are fertilization recommendations, consisting of five levels, namely F1 = 100 kg Urea ha^{-1} (Farmer 1); F2 = 150 kg Urea/ha farmer 2; F3 = 100 kg Urea + 200 kg NPK ha^{-1}; F4 = 150 kg Urea + 250 kg NPK ha^{-1}; F5 = 1/2 F3 + liquid organic fertilizer (LOF) Compost. From two factors, 25 treatment combinations were obtained. Each combination of treatments was repeated three times, resulting in 75 experimental units. The growth and yield components modifiers were observed on determined 10 randomly sample crops per plot, while the yield of milled dry grain was observed on a sample plot of 2.0 m x 3.0 m = 6.0 m^2, then converted to milled dry grain yield ha^{-1}. Data analysis using statistical methods, consisting of analysis of variances (ANOVA) to determine the effect of treatment, and if significant, then followed by Duncan's Multiple Range Test (DMRT) at 95 percent confidence level. The results showed that there was an interaction between new high-yielding varieties and fertilization doses on the plant height, weight of 1000 g and weight of grain filled per clump, on the contrary there was no real difference in the number of maximum tillers and productive tillers per clump, the number of filled panicles and the percentage of empty panicles per clump, panicle length, and the yield of milled dry grain (per harvest plot and ha^{-1}). Variety of Rindang 2 with fertilizer dose of 150 kg Urea + 250 kg NPK ha^{-1} was the best. Inpago 8, Inpago 11, Inpago 12, Rindang 1 and Rindang 2 gave milled dry grain of uplant rice yield of 3.15 t; 2.69 t; 2.48 t; 2.22 t; and 2.08 t ha^{-1}, respectively. The five new high-yielding varieties gave milled dry grain of upland rice between 2.08 - 3.15 t ha^{-1} and had no noticeable effect, so that the five varieties can be used in the intrcropping corn and upland rice planting pattern in dry land in Maluku. The treatmen of 150 kg Urea + 250 kg NPK ha^{-1} gave the highest yield of upland rice milled dry grain (2.91 t ha^{-1}) but differed insignificantly compared to F3 and F5. When the recommnded fertilizer of 150 kg Urea + 250 kg NPK was not available, then fertilization recommendations of 100 kg Urea + 200 kg NPK ha^{-1} can be used.

Keywords: New Superior Varieties, Upland Rice, NPK Fertilizer, Maluku

Introduction

Rice is the main commodity for most agricultural communities in Indonesia and until now it is still a staple food consumed by around 90% of the Indonesian population (Jamil *et al*., 2020). Indonesia's land area covers an area of ± 191.09 million ha, consisting of dry land covering an area of ± 144.47 million ha, swampland covering an area of ± 34.12 million ha, non-swamp wetlands covering an area of ± 9.44 million ha, and the rest are residential/urban, mining areas and water bodies (reservoirs, lakes, rivers). Based on its ecosystem, dry land, swampland, and non-swamp wetlands are found in lowlands covering an area of ± 154.60 million ha and in highlands covering an area of ± 33.44 million ha. Based on climatic conditions, the land is found in wet climates covering an area of ± 175.39 million ha and in dry climates covering an area of ± 12.65 million ha. Meanwhile, based on soil acidity, land with acidic soil acidity is ± 146.46 million ha and those with non-acidic acidity are ± 41.58 million ha (Ritung *et al.,* 2015). The prospects for the development of dryland rice (with upland rice cultivation) are still very large, with an area of dry land that is still available (Lukman, 2014), and Maluku province is one of the most promising region to widely develop upland rice.

The potential availability of land for the development of food crop agriculture in dry land (including upland rice) in Maluku is recorded at around 822,551 ha consisting of agroforestry (129,136 ha) with a slope slope of 9% - 15% and lowlands (718,465 ha) with a slope slope of 3% - 8% (Susanto & Sirappa, 2007; and Santoso et al., 2021). Theamount used is only a small part of

305,136.40 ha (36%), so that opportunities for extensification development are still wide open, namely 542,464.64 ha or about 64% of the potential land. Likewise, the potential for increased production is quite large, because the productivity achieved at the farmer level is still relatively low. Based on data from Central Bureau of Statistics of Maluku Province (2017), the average productivity of upland rice for the last five years (2012 – 2016) in Maluku is still relatively low (2.33 t ha^{-1}) while the potential yield can reach 7.0 t ha^{-1} with the application of innovative technology (Fitria & Ali, 2014).

Increasing rice productivity on optimal land (irrigated rice fields) has sloped (*levelling off*) so that rice development is directed at sub-optimal land dry land (sour, sloped), saline land, swampland (tidal, swamp, peat) and other marginal lands. In addition, the Crop Index (IP) in Maluku is still relatively low, namely between IP 100 (dry and rainfed land) and rice IP 200 (rice fields), while the Agricultural Research and Development Agency has made a breakthrough in increasing rice production (rice) through the use of irrigated rice fields that are available more optimally through efforts to increase the crop index known as Rice IP 400 which in its implementation in the target development area uses two strategies, namely technological engineering and social engineering with the aim of optimizing space and time so that the crop index is maximized, then production and farmers' income also increase (Supriatna, 2012).

The opportunity to increase rice cropping index on dry and rainfed land in Maluku can be done with a water utilization optimization system. The Agricultural Research and Development Agency has developed innovative technology in an effort to increase the crop index through intercropping (Turiman) and/or intercropping (Tugiman) patterns of corn, gogo rice and soybeans both in dry land, rainfed rice fields, and swampland (Musyafak *et al*., 2018). Planting pattern Intercropping is a planting stem that can support sustainable agriculture because of the variety of plants grown on one planting area at the same time can increase land efficiency and productivity (Warman & Kristiana, 2018; and Karimuna et al., 2020).

Productivity is the ratio of total output to inputs used in production (Suwarto, 2012). To achieve higher land productivity, it is necessary to assess the factors that influence it, including landform, land use, and land suitability. Landform is the appearance of the earth's surface due to the process of genesis, giving rise to a distinctive shape characterized by dominant natural material physical properties, and its development can be associated with certain characteristics (Sunarto et al., 2014). Rice productivity is the contribution and interaction of various components of production technology. According to Sembiring (2007) the success of increasing rice production is more contributed by increased productivity than by increasing harvest area. The increase in productivity contributed around 56.1% to the increase in rice production, while the increase in harvest area and interaction of the two contributed only 26.3% and 17.5%, respectively. The interaction of the use of technological components of superior varieties, fertilization and irrigation will be able to contribute to an increase in yield up to 75% (Ruskandar, 2009). The real contribution of superior varieties to increasing national rice production is among others reflected in the achievement of rice self-sufficiency in 1984. This is related to the properties of superior varieties of upland rice, including high yield, resistance to major diseases, gene age so that it is suitable to be developed in certain planting patterns, and the taste of good rice (fluffy) with relatively high protein content (Nazirah & Damanik, 2015).

High-yielding varieties will not show their superiority without being supported by optimal cultivation techniques, especially fertilization. Fertilization can be interpreted as the provision of organic and non-organic matter to replace nutrient losses in the soil and to meet nutrient needs for plants so that productivity plants are increasing (Mansyur et al., 2021). Thus, the interaction of the use of new high-yielding varieties and the act of fertilizing with the right dose is expected to result in an increase in the productivity of cultivated plants.

Based on the description above, it is considered necessary to carry out the research on the response of various upland rice varieties as new superior upland rice to fertilizing, with the aim of obtaining new high-yielding varieties of specific upland rice effective location and fertilization support the intercropping pattern of Maize + upland Rice on dry land in Maluku

Methodology

The research was conducted at KP Makariki Maluku Agricultural Technology Research Institute, Amahai District, Central Maluku Regency, Maluku Province, which took place from May to September 2020, with the aim of determining the effect of varieties and fertilizer doses on the growth and production of upland rice plants on dry land in Maluku. The study was conducted with a "field experiment" approach using a Divided Plot Design with 25 treatment combinations and three repeats. The treatment consists of Main Plot, five types of new high-yielding varieties (NHV), namely Inpago 8 (V1), Inpago 11 (V2), Inpago 12 (V3), Rindang 1 (V4) and Rindang 2 (V5); Subplot, consists of five fertilization recommendations, namely 100 kg of Urea ha-1 as a recommendation of farmers 1 (F1), 150 kg of Urea ha-1 as a recommendation of farmers 2 (F2), 100 kg of Urea + 200 kg of NPK ha-1 as a recommendation of Turiman Jago (F3), 150 kg of Urea + 250 kg of NPK ha-1 as a recommendation of PUTK/Dry Soil Test Device (F4) and 1/2 F2 + LOF Compost (F5). From two factors, 25 treatment combinations were obtained and each treatment combination was repeated three times, resulting in 75 experimental units.

The size of the treatment plot area is 10.0 m x 5.0 m = 50 m^2. Planting is carried out tugal with a legowo planting distance of 2:1 (40 cm x 20 cm (3 – 5 grains per hole). The dose of fertilization is according to the treatment of subplot. Fertilizer is given three times, namely; (1) 10 days after planting with a dose of fertilizer 1/3 kg Urea + 1/2 kg NPK ha^{-1}, (2) 35 days after planting with a dose of 1/3 kg Urea + 1/2 kg NPK ha^{-1}, and (3) at the time of flower primordia with a dose of 1/3 kg Urea ha^{-1}. Compost liquid organic fertilizer measuring 2.0 ml / L of water with a spray volume of 500 L ha^{-1} is applied three times, namely 10 Days After Planting (DAP), 45 DAP, and 75 DAP. Weed control is carried out physically, namely hand weeding 21 DAP and 42 DAP, followed by seasoning at the age of 28 DAP. Pest and disease control is carried out on a scheduled basis, namely the administration of Carbofuran (16 kg of material / ha / application) given at the age of 10 DAP and 30 DAP. Vegetative phase pest control is carried out by spraying insecticide Bisultap (2 cc material / L water) at the age of 14 DAP to the flower primordia phase with spraying intervals every two weeks. In the generative phase two weeks after primordia, flowers are sprayed with Diphenoconazole (0.5 cc b.a/L water) until two weeks before harvest with spraying intervals once every two weeks.

Observed modifiers include: 1) growth components (plant height at harvest, and maximum number of tillers) observed at the time before harvesting; 2) yield components (number of productive tillers per clump, panicle length, percentage of empty panicles per clump, number of grains contained per panicle, percentage of empty grain per panicle, weight of 1000 dry seeds, weight of Milled Dry Grain per clump); and 3) the yield of gabah kering harvest per plot of harvest (t ha^{-1}).

Growth component and yield component modifiers were observed against 10 randomly determined sample crops per plot, while harvested dry grain yield was observed on sample plots (yams) 2.0 m x 3.0 m = 6.0 m^2. Dry Milled conversion formula ha^{-1} = Yield (kg) x (10,000 m^2 : 6.0 m^2) http://cybex.pertanian.go.id (accessed July 27, 2022).

Technical agronomic aspects (plant growth, yield components and yield) were analyzed using Analyses of Variances (ANOVA) to determine the effect of treatment and if significant, then followed by Duncan's Multiple Range Test at 95 percent confidence level to determine the difference between treatments tested, following the Gomez and Gomez (1995) procedures.

Results And Discussion

Plant Height

The results of variety analysis show that the interaction between new high-yielding varieties and fertilization has a significant effect on plant height at harvest (Table 1).

Table 1. The Effect of the Interaction of New Superior Varieties and Fertilization on the Height of Upland Rice Plants (cm) KP Makariki (Central Maluku) Cropping Season 2020

New High Yielding Varieties	Fertilization Recommendation (FR)					Average
	F1	F2	F3	F4	F5	
Inpago 8	^{C}109.9 c	^{AB}114.0 d	^{A}121.4 c	^{AB}118.9 c	^{AB}115.4 b	115,92
Inpago 11	^{C}123.0 ab	^{A}130.1 bc	^{A}131.7 a	^{A}130.3 ab	^{A}130.1 a	129,04
Inpago 12	^{B}120.0 ab	^{A}144.2 a	^{A}144.3 b	^{B}128.8 ab	^{B}123.7 ab	132,20

Rindang 1	^{C}110.7 c	^{A}121.5 cd	^{A}120.3 c	^{A}122.3 bc	^{AB}116.9 b	118,33
Rindang 2	^{C}124.2 a	^{B}132.2 b	^{A}135.7 a	^{A}133.9 a	^{AB}130.8 a	131,35
Average	117,57	128,41	130,68	126,81	123,36	

Notes: - The average number followed by different small letters in the same column (a,b,c) and preceded by different capital letters in the same row, differs markedly at a 95% confidence level, DMRT test.

- F1 = 100 kg Urea ha^{-1} (farmer's recommendation 1);

F2 = 150 kg of Urea ha^{-1} (farmer's recommendation 2);

F3 = 100 kg Urea + 200 kg NPK ha^{-1};

F4 = 150 kg Urea + 250 kg NPK ha^{-1};

F5 = ½ F2 + POC Compost.

Table 1 indicates that the average plant height of the highest (135.7 cm) of upland rice is found in variety of Rindang 2 with fertilization F3 (100 kg Urea + 200 kg NPK ha^{-1}) and different from varieties of Inpago 11 and Inpago 8. Likewise, the treatment of F3 differs inmarkedly from F4 (150 , kg of Urea + 250 kg of NPK ha^{-1}) and F5 (½ F2 + POC Compost). The height of the Rindang 2 obtained in this study is not much different from the othes, which is ±138 cm (Agricultural research and development center, 2019). The lowest plant height (109.9 cm) of upland rice is found in the Inpago 8 variety with control (F1 = 100 kg Urea ha^{-1}).

According to Agricultural research and development center, 2016 that the Inpago 8 variety has a shorter plant height (1 2 2 cm) compared to other new high yielding varieties. The F1 treatment (Farmer 1) showed a markedly lower average plant growth (117.57 cm) compared to other fertilization treatments (Table 1). Plant growth includes height, starting from the process of bud formation which is a process of cell division and enlargement. The process of cell division and enlargement can only occur at high turgidity levels (Kramer, 1983; and Ferdian et al., 2017). Plant height is one of the indicators of plant growth that is easily seen (Sitompul & Guritno, 1995*;* and Rahayu *et al*., 2016).

Maximum Number of Tillers

The number of tllers is one of the genetic traits and plays an important role in determining the productivity of rice plants. Plants with a high number of tillers are predicted to have higher productivity compared to plants with a small number of tillers. Many tillers are influenced by genetic traits, which must be supported by adequate growth factors and environment. Active tillers are formed quite a lot because plants are grown in ideal conditions, there are no limiting factors from biotic or abiotic environments including space in the formation of tillers.

The results of variety analysis showed that new high yielding varieties had no significant effect on the maximum number of tillers, but fertilization had a real effect on the number of max tillers, while the interaction between new high yielding and fertilizer was not real (Table 2).

Table 2. The effects of new high-yielding varieties and fertilization on the maximum number of upland rice tillers. KP Makariki (Central Maluku). Cropping Season 2020

New High Yielding Varieties	Rcommendation Fertilization					Average
	F1	F2	F3	F4	F5	
Inpago 8	18,3	19,7	20,3	19,9	19,4	19.5 A
Inpago 11	20,6	20,0	19,4	20,5	20,8	20.3 A
Inpago 12	17,9	19,3	20,0	21,6	19,1	19.6 A
Rindang 1	19,4	21,5	20,9	21,3	20,5	20.7 A
Rindang 2	18,4	20,6	20,1	21,1	20,1	20.1 A
Average	^{B}18.9	^{AB}20.6	^{AB}20.1	^{A}20.9	^{B}20.0	20.0

Notes: - The average number followed by unequal letters in the same column differs markedly at a 95% confidence level, DMRT test.

- Inline average numbers preceded by unequal letters differ markedly between fertilization treatments at 95% accuracy

level DMRT Test.

- F1 = 100 kg Urea ha^{-1} (farmer’s recommendation 1);
- F2 = 150 kg of Urea ha^{-1} (farmer's recommendation 2);

F3 = 100 kg Urea + 200 kg NPK ha^{-1};

F4 = 150 kg Urea + 250 kg NPK ha^{-1};

- F5 = ½ F2 + POC compost.

Table 2 shows that although new high-yielding varieties have no significant effect on the maximum number of tillers, the Rindang 1 variety gives the highest maximum number of tillers and the Inpago 8 variety gives the lowest number of tillers. Furthermore, Table 2 shows that the F4 fertilization treatment gave the highest number of maximum tillers (20.9 tillers per clump), but was not significantly different from the F2 and F3 treatments. The lowest number of tillers (18.9 tillers per clumps) was achieved in the F1 fertilization treatment and was significantly different from other treatments except for the F5 treatment.

The pattern of increasing the number of tillers per clump is significantly influenced by the treatment of the number of seedlings per hole. The average increase in the number of tillers per clump at the age of 15 - 30 DAP is strongly influenced by the number of seedlings per planting hole. There is a close relationship (correlation) between the number of seedlings per hole with the addition of the number of tillers per clump at the age of 15 - 30 DAP (Wahyu Wibawa and Dedi Sugandi, 2017). The increase in the number of tillers is directly proportional to the number of seedlings per hole. The more seedlings per hole, the more the increase in the number of tillers

Number of Productive Tillers per Clump, Panicle Length, Number of filled Panicles per Clump and Percentage of Empty Panicles Per Clump

The results of variances analysis (Table 3) showed that new high yielding varieties had a significant effect on panicle length and percentage of empty panicles, while on the number of productive tillers per clump and panicle length had no real effect. Table 3 shows that the Inpago 8 variety gives more productive tillers per clump, the length of real panicles is longer, the number of filled panicles per clump is more and the percentage of empty panicles per clump is markedly lower compared to other new high yielding varieties.

Furthermore, Table 3 shows that fertilization and interaction between new high yielding varieties and fertilization showed no real effect on panicle length, number of panicle panicles per clump and percentage of empty panicles per clump, except for the number of productive tillers per clump had a real effect. F4 fertilization treatment gives the number of productive tillers per clump tends to be higher (12.8 tiilers per clump), panicle length tends to be longer (30.1 tillers per clump), the number of filled panicles per clump tends to be higher (12.5 panicles per clump), and the percentage of empty panicles per clump tends to be lower (11.7% per clump) compared to other fertilization treatments (Table 3).

Rice plants will produce a greater number of productive tillers if the dose given is optimal. Conversely, if given at a dose that is not optimal, then its growth will be inhibited. This is due to the P function which is able to stimulate the formation of the number of productive tillers, so that with the right dose it will increase the number of tillers produced.

Table 3. Effect of New High-yielding Varieties and Fertilization on Number of Productive tillers, Panicle Length, Number of filled Panicles per Clump, and Percentage of upland rice Panicles per Clump. KP Makariki (Central Maluku). Cropping Season 2020

New high-yielding varieties	Number of Productive Tillers per Clump	Panicles Length (cm)	Number of Filled Panicles per Clump	Percentage of empty panicles per clump (%)
Inpago 8	13.0 A	30.2, a	13.3, a	,9.75 b
Inpago 11	11.2 A	28.5, ab	11.5, A	12.24, a
Inpago 12	12.5 A	29.9, a	12.8 A	11.25, ab
Rindang 1	11.6 A	28.4, ab	11.0, A	12.48, a
Rindang 2	11.0 A	25.1, b	10.9, A	13.03, a
Fertilization Recommendations				
100 kg Urea ha^{-1} (F1)	9.6 b	27.4, a	10.6, A	12.3, A
150 kg of Urea ha^{-1} (F2)	12.2 a	28.2, a	11.9, A	11.8, A
100 kg Urea + 200 kg NPK ha^{-1}; (F3)	12.6 A	27.8, a	12.4, a	12.2, a
150 kg Urea + 250 kg NPK ha^{-1} (F4)	12.8 A	30.1, a	12.5, A	11.7, A
½ F2 + POC compost (F5)	12,3 a	28,6 a	12,0 a	10,8 a
Interaction	ns	ns	ns	ns

Notes: - The average number followed by unequal letters in the same column differs markedly at a 95% confidence level, DMRT test. ns = non significant

It is suspected that there is a correlation between an increase in the number of tillers with an increase in the number of productive tillers, so that an increase in the number of tillers will stimulate the emergence of productive tillers produced. Increasing K levels through fertilizers applied in the soil will have an impact on increasing the number of productive tillers produced by rice plants (Kurnia, 2011).

In general, the application of NPK and Urea fertilizers separately can produce a higher number of panicles when compared to treatment without NPK or Urea fertilizers, this is because the existing N (NPK and Urea) can be absorbed optimally so that it can meet the needs of N during growth, accelerate plant growth, increase leaf size so as to increase the number of productive tillers that will become panicles in one clump

The length of the panicle is an important component in determining plant yield, where the longer the panicle, the more the number of grains is expected. Panicles are formed when entering the generative phase. In this phase rice requires sufficient water availability and the need for N available to plants because in this phase plant cells are very active in dividing, and the division process will be better if the supply of N is available to plants (Putra et al., 2018).

The number of panicles is strongly influenced by environmental conditions, climatic factors and water availability, if these conditions are relatively the same, then the dominant influence is fertilization, because the application of inorganic fertilizers and organic fertilizers or green manure has been able to play an important role in the formation of tillers and the reproductive phase of plants, the number of panicles and grain obtained is also different based on the dose of fertilizer given.

Dry Weight of 1000 grains

The results of variety analysis as presented in Table 4, show that the interaction of new high-yielding varieties of upland rice and fertilization has a significant effect on the weight of 1000 grains. The interaction of the Rindang 2 variety with the F4 fertilization treatment gave a markedly higher weight of 1000 grains (32.93 g) compared to other interactions. Based on the description, the Rindang 2 variety has a weight of 1000 grains of 31.3 g (Agricultural Research and Development Center. 2019), but when combined with F4 fertilization, the weight of 1000 grains increases by 32.93 g (Table 4). Likewise, the interaction of the Inpago 8 variety with F1 fertilization gives the lowest 1,000 grain weights (24.40 g), but differs markedly compared to other varieties and fertilizations. According to the description, Inpago 8 has a dry weight of 1000 grains of 27.3 g (Agricultural Research and Development Center, 2016), but when combined with F1 fertilization treatment, the weight of 1,000 grains decreases by 24.40 g (Table 4).

Table 4. The effect of new high-yielding varieties and fertilization on the weight of 1000 upland rice grains. KP Makariki (Central Maluku). Cropping Season 2020

New High-Yielding Varieties	Recommendation Fertilization					Average
	F1	F2	F3	F4	F5	
Inpago 8	^{A} 24,40 a	^{A} 23,28 b	^{A} 29,32 a	^{A} 29,82 a	^{A} 28,10 ab	26,98
Inpago 11	^{A} 23,78 a	^{A} 25,91 ab	^{A} 26,38 ab	^{A} 26,81 a	^{A} 25,85 ab	25,75
Inpago 12	^{B} 26,65 a	^{AB} 29,65 a	^{AB} 26,04 ab	^{AB} 26,73 a	^{A} 24,11 b	26,64

Rindang 1	A 28,96 a	A 27,03 ab	A 25,16 b	A 27,82 a	A 28,00 ab	27,39
Rindang 2	B 29,37 a	AB 31,48 a	AB 32,54 a	AB 32,93 a	AB 31,45 a	31,45
Average	25,63	27,47	27,89	28,71	27,50	

Notes: - The average number followed by different small letters in the same column (a,b,c) and preceded by different capital letters in the same row, differs markedly at a 95% confidence level, DMRT test.

- F1 = 100 kg Urea ha^{-1} (farmer's recommendation 1);
- F2 = 150 kg of Urea ha^{-1} (farmer's recommendation 2);

  F3 = 100 kg Urea + 200 kg NPK ha^{-1};

  F4 = 150 kg Urea + 250 kg NPK ha^{-1};
- F5 = ½ F2 + POC compost.

Lacerda & Nascente (2016) reported that rice crop production depends on at least three components, namely the number of tillers, the number of panicles and the weight of 1000 grains. Ma'sum et al., (2016) stated that the amount of rice yield per hectare is determined by production components. The components of the result include the number of panicles per clump, the number of grains per panicle, the weight of 1000 seeds and the percentage of filled grains.

Dry Filled Grain Weight per Clump

The results of variance analyses as presented in Table 5 show that the interaction between new high yielding variety treatment and fertilization has a significant effect on the dry weight of filled grain per clump. The Inpago 8 variety with F4 fertilization dose (150 kg Urea + 250kg NPK ha^{-1}) gives the highest dry grain weight per clump (24.3 g per clump) and differs markedly from the Rindang 1 variety and F2 fertilization (150 kg Urea ha^{-1}), but differs insignificantly from new high yielding variety and other fertilization doses (Table 5).

Table 5. Effect of new high-yielding varieties and fertilization on dry filled grain weight per clump (g per clump). Upland Rice. KP Makariki (Central Maluku), Cropping Season 2020

New High-Yielding Varieties	Recommendation Fertilization					Average
	F1	F2	F3	F4	F5	
Inpago 8	B 17,56 ab	AB 22,32 a	AB 20,73 a	AB 24,33 a	AB 20,32 a	21,05

Inpago 11	A 14,25 a	A 17,51 a	A 17,73 abc	A 21,18 ab	A 16,17 ab	17,37
Inpago 12	B 15,75 ab	AB 18,07 a	AB 20,57 ab	AB 21,27 a	A 22,15 a	19,56
Rindang 1	A 10,20 b	A 10,34 b	A 11,69 c	A 13,47 b	A 11,56 c	11,45
Rindang 2	A 13,68 ab	A 16,50 a	A 15,12 abc	A 17,53 ab	A 15,19 b	15,60
Average	14,29	16,95	17,17	19,56	17,08	

Notes: - The average number followed by different small letters in the same column (a,b,c) and preceded by different capital letters in the same row, differs markedly at a 95% confidence level, DMRT test.

- F1 = 100 kg Urea ha^{-1} (farmer’s recommendation 1);
- F2 = 150 kg of Urea ha^{-1} (farmer's recommendation 2);

  F3 = 100 kg Urea + 200 kg NPK ha^{-1};

  F4 = 150 kg Urea + 250 kg NPK ha^{-1};

- F5 = ½ F2 + POC compost.

Conversely, Rindang 1 with the F1 fertilization dose gives the lowest dry grain weight per clump (10.20 g per clump) and is significantly different from Inpago 11, but not significantly different from other fertilization doses.

Dry milled grain yield

The yield of milled dry grain was observed against the weight of milled dry grain per harvest plot (g per 6 m^2) and converted to the yield of dry milled grain t ha^{-1}. Based on the results of variance analysis (Table 6), solely varieties and fertilization and their interactions show an intangible influence on the weight of harvested dry grain per crop plot. Inpago 8 gives the highest weight of milled dry grain per plot of harvest and the highest yield of milled dry grain per hectare of 1890.00 g per 6 m^2 and 3.15 t ha^{-1} respectively and differs insignificantly from other varieties (Table 6). While Rindang 2 provides the lowest weight of milled dry grain per plot of harvest and the lowest yield of harvested dry grain per hectare of 1250.00 g /6 m^2 and 2.08 t ha^{-1}, respectively. Furthermore, Table 6 shows that fertilization has no real effect on the weight of milled dry grain per crop plot and the yield of milled dry grain per hectare.

The fertilization treatment of 150 kg Urea + 250 kg NPK ha^{-1}(F0) gave the highest weight of milled dry grain per crop plot and the highest yield of milled dry grain per hectare of 1743.60 g per 6 m^2 and 2.91 t ha^{-1}, respectively, and was not significantly different from other fertilization treatments (Table 6), while the treatment without fertilizer as control gave the lowest weight of milled dry grain per plot of harvest and the lowest yield of harvested dry grain per hectare (1241.20 g per 6 m^2) and 2.07 t ha^{-1}, espectively, and differs unmarkedly from other fertilization treatments. Fertilizer dose of 150 kg Urea + 250 kg NPK ha^{-1} (F3) as dry soil test device gives a markedly higher yield of Milled Dry Grain (2.91 t ha^{-1}), but differs markedly compared to F3 (2.63 t ha^{-1}) and F5 (2.74 t ha^{-1}).

Table 6. The effect of new high-yielding varieties and fertilization on milled dry grain yield harvested per Plot and per hectare of upland rice. Experimental Garden of Makariki (Central Maluku). Cropping Season 2020

Treatment	Milled dry grain yield harvested per Plot (g per 6 m^2)	Milled dry grain yield per hectare (t ha^{-1})
New High Yielding Varieties		
Inpago 8	1890,00 a	3,15 a
Inpago 11	1490,00 a	2,69 a
Inpago 12	1614,80 a	2,48 a
Rindang 1	1330,00 a	2,22 a
Rindang 2	1250,00 a	2,08 a
Recommendation Fertilization		
100 kg Urea ha^{-1} (F1)	1241,20 a	2,07 c
150 kg of Urea ha^{-1} (F2)	1371,60 a	2,29 bc
100 kg Urea + 200 kg NPK ha^{-1}; (F3)	1575,60 a	2,63 ab
150 kg Urea + 250 kg NPK ha^{-1} (F4)	1743,60 a	2,91 a
½ F2 + POC compost (F5)	1642,80 a	2,74 a
Interaction	ns	ns

Notes: - The average number followed by unequal letters in the same column differs markedly at a 95% confidence level, DMRT test. ns = non significant

CONCLUSIONS

New high-yielding varieties and fertilization have a markedly better interaction effect on plant height, weight of 1000 grains and weight of grain contains per clump, but no real effect on the number of maximum tillers and productive tillers per clump, number of filled panicles and percentage of empty panicles per clump, panicle length, dry weight of milled grain per plot and yield of dry milled grain ha^{-1}.

Rindang 2 variety with fertilization of 150 kg Urea + 250 kg NPK ha^{-1} as PUTK recommendation is the best treatment combination, Inpago 8, Inpago 11, Inpago 12, Rindang 1 and Rindang 2 give dry upland rice milled grain yield of 3.15 t ha^{-1}; 2.69 t ha^{-1}; 2.48 t ha^{-1}; 2.22 t ha^{-1}; and 2.08 t ha^{-1}, respectively and has no real effect, so that the five varieties can be used in the planting pattern of intercropping corn – upland Rice in the dry land of Maluku Province

Fertilization with a dose of 150 kg Urea + 250 kg NPK ha^{-1} as a recommendation for Dry Soil Test Device gives the highest yield of dry milled upland rice ha^{-1} (2.91 t ha^{-1}), but differs not significantly compared to the fertilization dose of 100 kg Urea + 200 kg NPK ha^{-1} as recommended for intercropping corn and upland rice and the fertilization dose of 1/2 F3 + LOF Compost respectively 2.63 t ha^{-1} and 2.74 t ha^{-1}.

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