

Enhancement of Upland Rice Production in Various Agro-Ecosystems

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Abstract: The study aimed to determine the potentials of various agro-ecosystem in producing favorable growth and yield of upland rice including biomass production and carbon storage. Results of the study revealed that hinumay and dinorado were performed significantly better in plant height, yield, biomass and carbon content as compared to other varieties. However, in terms of panicle length and number of tillers, it was found out that kawilan variety perform better but it is not significantly different with hinumay and dinorado. With the current findings, hinumay and dinorado were the best upland rice varieties to be cultivated under oil palm, coconut and rubber tree but not to banana agro-ecosystem. On the other side, for early flowering and maturity, it was found out that the 90 days variety significantly bear flower and matured earlier as compared with the other upland rice varieties.

Keywords: Agro-Ecosystem, Coconut, Rubber, Oil Palm, Banana, Upland Rice

1. Introduction

Rice (*Oryza sativa* L.) which is mainly used as staple food crop now definitely occupies a major position among Philippines Agricultural crops. As a cereal staple it is consumed by more or less 80% of Filipinos mostly from Luzon and Mindanao regions (Vergara 1983).

Rice on-farm adaptive research is designed to solve farmer's major technical problems in production. High yielding, aromatic and early maturing upland rice are one of the vital considerations in crop production practices especially in farmer's field (Frusita 1984).

The main reason for the low yield of upland rice in the farmer's field is the high cost of production which is continuously rising following the price in crude of fossil oil products. Commercial fertilizer is among the inputs of which its price soared up to the highest level in the history. Hence, it is necessary to look for substitute fertilizer which could reduce dependency on commercial and synthetic fertilizer but

could sustain the production of upland rice (Zamora 2005).

The current challenge for rice researched is to grow in size, in scope and ability to serve the pressing need for more upland rice products (Tanchuling 2005).

Rice is grown in the country in nearly all regions. In region XII particularly North Cotabato and specifically in the Municipality of Arakan, upland rice is one of the major crops grown for family consumption and even for supply to the market demand. Arakan has a vast covering of 69,321.56 hectares, thirty percent of this area is being utilized for agricultural purposes like crop production by the small holder and subsistence farmer sector that are known to be the prime mover of the Arakan economy (LUPA, 2007).

This study aim to enhance upland rice production through various agro-ecosystems in Arakan Valley Complex.

2. Methodology

This study was conducted in Arakan Valley Complex (Figure 1) with three locations {CFCST (N07°20.694';

125°05.316¹E) in brgy. Doroluman, Arakan; Brgy. Arakan (N7°06.355¹; 124°49.135¹E) Matalam; and Brgy. Libpas(N7°21.763¹; 124°56.218¹E) Pres. Roxas all in Cotabato Province} to determine the production of five

indigenous upland rice cultivars (e.g. Dinorado; 90 days; Goyudin; Maluwa; and Hinumay) along alleys of 1 year rubber (*Hevea brasiliensis*), african oil palm (*Elaeis guineensis* Jacq.), and banana (*Musa sapientum*) plantations.



Figure 1. Map of Arakan Valley Complex.

1. **Land Preparation.** The area identified had been slashed, plowed twice and harrowed 2 times to obtain good soil porosity before planting
2. **Planting.** Planting distance will be 25 cm per furrows and hills
3. **Fertilization.** Vermi compost was applied 1 week before planting at a rate of 100 bags per hectare.
4. **Cultural Management.** The crop were maintained by weeding, spraying, rouging and close monitoring on pests and diseases.
5. **Data Collection.** Data gathered were as follows: seedling vigor, days to heading, days to maturity, plant height, tiller count, panicle count and length, lodging rating, and grain yield
6. **Harvesting to Post-harvest Operation.** Harvesting

depends on the upland rice variety planted whether it is early or late maturing varieties. To ensure a good quality seeds, harvest it on time, post harvest activities like, drying and sacking.

2.1. Farmer Co-operators

There were three male farmer co-operators identified and served as maintenance and care taker of the experimental plots in the three barangays namely: Brgy. Doroluman Arakan, (Located at CFCST); Brgy Arakan Matalam; and Brgy Libpas Pres. Roxas, all of Cotabato Province. Their age ranges from 30-36 years, all married with an average siblings of 4 and estimated monthly income of five thousand pesos (Php 5,000,00) from fishing, gardening and contract of work.

The three farmer co-operators were all magindanawn

(Islam in religion). They have cultivated an average upland rice of 1 ha each with other farm commodities such as corn and plantation crops (banana, coconut and rubber trees).

2.2. Biophysical Characteristics of the Upland Rice Area

Table 1 presents the biophysical characteristics of three the experimental sites in North Cotabato

Table 1. Shows the biophysical characteristics of the three sites.

	Arakan	Matalam	Pres. Roxas
Biological Characteristics			
Climate Type	IV	IV	IV
Mean Annual Rainfall			
Mean Annual Temperature			
Edaphic	32°C	32°C	32°C
Soil pH	6.0/7.0	6.2/7.2	6.0/7.2

	Arakan	Matalam	Pres. Roxas
Soil Type	Sandy Clay	Sandy Loam	Sandy Clay
Nitrogen	Moderate	Moderate	Moderate
Phosphorus	Low	Low	Low
Potassium	Low	Low	Low
Physical Characteristics	148m	97m	104m
Physiographic Attribute	Plain	Moderate	Moderate
Elevation	Banana	Banana	Banana
Soil Gradient/Slope	Palm Oil	Palm Oil	Palm Oil
Plantation	Rubber Tree	Rubber Tree	Rubber Tree
Other Vegetative Cover	Cogon	Cogon	Cogon
	Grasses	Grasses	Grasses

2.3. Upland Rice

2.3.1. Germination Percentage

Hinumay found to have higher percentage of germination in Arakan and Pres. Roxas location of 92.5% and 90% respectively. While dinorado has higher germination of 92 percent in Matalam site (Figure 2)

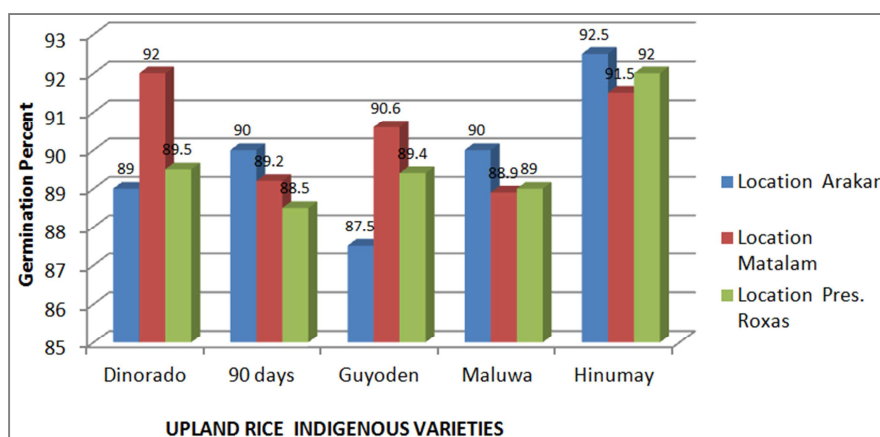


Figure 2. Germination percent of various upland rice variety in different locations.

2.3.2. Agronomic Characteristics of the Upland Rice

Hinumay and dinorado upland rice varieties were found to be significantly taller in height (176cm and 156cm) as compared to other varieties tested. For the length of panicles, kawilan (35cm) has the longest panicle but not significantly

different with the panicle length of hinumay, dinorado and the 90 days varieties (Table 2).

Kusin 2002 stated that hinumay and dinorado were the same upland rice varieties that grows taller as compared to other indigenous varieties in Arakan Cotabato.

Table 2. Agronomic Characteristics of the upland rice varieties.

Upland Rice Variety	P. Height (cm)	Length of Panicle	No. of Tillers	Days to Flowering	Days to Maturity
Dinorado	156a	24.7ab	31a	62a	113a
Hinumay	176.1a	30.1a	30.3a	61a	114.7a
Kawilan	115.7b	35.1a	33.7a	58ab	111a
90 Days	94.6c	24.2ab	13.5b	55b	93b
Goyuden	128b	19.2b	17bc	67a	116a
Maluwa	124b	18.5b	20b	59a	105ab

Mean with the same letter subscript (vertically) are not significantly different at 5% level

Kawilan also found to have the most number of tillers (33.7) but this number did not differ significantly with the tillers of hinumay and dinorado as revealed in the Duncan Multiple Range Test. According to Kusin 2002, hinumay and dinorado produces more tillers when applied with organic fertilizer.

For the days to flowering, it was found out the 90 days and

kawilan varieties early bear flowers (55 days and 58 days).

At 93 days, the 90 days variety matured significantly as compared to the other treatments. However, this maturity days did not vary significantly with maluwa of 105 days.

2.3.3. Yield, Biomass and Carbon Content

The weight of 1000 seeds reported to be highest in dinorado (23.4g), kawilan (23g) and hinumay (22g). For the

yield, it was found out that hinumay 8.2 t/ha) and dinorado (7.2t/ha) significantly higher as compared to the other varieties.

The same results had been found for biomass and estimated carbon content. Dinorado and hinumay has the

highest biomass and carbon content (table 3). The study of Kusin 2002 revealed that hinumay produces more yield but the difference is not significant with dinorado variety applied with organic fertilizer.

Table 3. Yield and Biomass with estimated carbon density.

Upland Rice Variety	Wt of 1000 Seeds (grams)	Yield (kg/ha)	Biomass (kg/10hills)	Carbon Potential (Mt/ha)
Dinorado	23.4a	7,280.35a	400a	0.18a
Hinumay	22a	8,245.05a	395a	0.178a
Kawilan	23a	3,816.67b	342b	0.154ab
90 Days	18.5b	3,650.10b	245c	0.11b
Goyuden	19b	5,426.25b	115c	0.052c
Maluwa	20.2b	4,724.50b	340b	0.153ab

Mean with the same letter subscript (vertically) are not significantly different at 5% level

Table 4. Yield of upland rice varieties as influence by various agro-ecosystem.

Upland Rice Variety	Palm Oil	Rubber Tree	Coconut	Banana
Dinorado	7,567.5a	6,480.35a	6,555.4a	5,980.45b
Hinumay	8,253.05a	7,645.05a	7,100.5a	5,990.4b
Kawilan	3,600.25b	3,816.67b	2,696.3b	3,003.5b
90 Days	3,554.85b	3,650.10b	3,460.4b	3,050.45b
Goyuden	5,200.5b	5,426.25b	4,500.9b	4,360.2b
Maluwa	3,670.5b	4,724.50b	4,500.35b	4,453.3b

Mean with the same letter subscript (vertically and horizontally) are not significantly different at 5% level

2.3.4. Yield of the Different Agro-ecosystems

maximum of 0.18 Mt per ha.



Figure 3. Upland rice + Palm oil.

Upland rice with Palm oil has the highest yield found (Table 4). Dinorado (7,567.5kg/ha) and hinumay (8,253.05kg/ha) significantly higher in yield but it is not significantly different with yield under rubber and coconut plantations. The least yield of upland rice was found under banana plantations and found out that the different varieties perform insignificantly under this agro-ecosystem.

Figure 3 shows the upland rice along alleys of palm oil.

3. Conclusion

- Hinumay and dinorado upland rice varieties has the highest yield and biomass regardless of agro-ecosystem
- The early maturing variety is 90 days and maluwa
- Carbon storage potential of upland rice will reach to a

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