

APPLICATION FOR RELEASE OF THREE UPLAND-RICE VARIETIES

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TABLE OF CONTENTS

Introduction.....	1
Pedigree.....	1
Inbred Lines Maintenance.....	1
Results and discussions.....	1
Grain quality and farmer preferences.....	2
Descriptive data of WAB450, ITA 257 & ITA 325.....	4
Agronomic packages.....	5
Characteristics of promising varieties.....	7

Appendix 1 Tables

Yield of 10 Upland varieties 2001B.....	8
Performance of upland varieties for drought stress trials	10
Yield of upland varieties for drought stress trials	11
Performance trials 2002A.....	12

Introduction

Uganda does not yet produce sufficient rice for domestic consumption. The government Uganda responded to the need by opening piloted rice schemes during 1970s with basically the lowland cultures of production. These were characterized by high initial cost of land clearing as well as cultural, health and environmental related reservations to cultivate the wetlands. Subsequently fairly tolerant varieties were selected but could not provide stable yield under slight drought stress conditions. Drought stress, efficiency of mineral extraction and resistance/tolerance to biotic stress therefore became very important research issues.

In response to the above constraint, the Cereal programs in collaboration with stakeholders notably the farmers and West African Rice Development Authority (WARDA) and Makerere University Faculty of Agriculture conducted research geared towards selecting suitable upland rice varieties.

Pedigree of IITA 257, IITA 325 & WAB 450

The origin of inbred IITA International Institute for tropical Agriculture (IITA) and West African Rice Development Authority (WARDA) have undergone five generations of further selfing and selection for adaptation in our environment.

WAB 450 is one of the breeding lines of *Oryza sativa* crossed *O. glaberrima* the African wild rice code named series WAB 450 IBP91HB. IITA 257 and IITA 325 are land races from Asiatic rice varieties.

Inbred lines maintenance

The inbreds will be maintained by bulk sibbling with occasional selfing in order to maintain their identity.

Results and Discussions

Both On-farm and on-station works were conducted. Preliminary screening on station involved selection from breeding lines of 110 variety basing on duration in the field and

vigor. The on-station activities involved seed increase and evaluation of 16 upland varieties under adequate moisture during 1999 seasons A and B.

Sixteen varieties were advanced for stress tolerance trial and 10 varieties for on farm trials. The on-farm trial was conducted through participatory and multi-locational testing of the 10 upland varieties. Key districts to represent Uganda ecological zones were selected. Lira and Apac districts were for northern zone, Pallisa and Bugiri for Eastern and Kamwenge for western zone. In each district two sub-counties in which rice is grown were selected and two farmers per sub-county selected. Four interested farmers were selected per district

Ten varieties were tested in each farmer's field with plot size 3 X 8 m. Planting method was line dibbling at spacing of 30 cm and seed rate 80 Kg/ha. Joint evaluation was done with the researchers, farmers and extension agents. Farmers views for selection of varieties included maturity time, grain size, panicle length and the overall yield. The application rate for Urea 222Kg :Tri Amonium Phosphate113.6Kg or 222Kg urea:238 Kg SSP.

Grain quality and farmer preference

Grain Appearance

The varieties considered slender were Abilony, NP3, WAB 450, BASIMU, WAB 189 and PR 2348.10. The varieties IRAT 284, ITA 257, ITA 325 and Sikamu were ranked medium. There was no round variety. Most varieties available in the market are slender and the farmers seem to like them. The new varieties may have a good entry point to the market.

Aroma

All the varieties tested were weakly aromatic with the varieties exhibiting higher aromatic levels being IRAT 284, ITA257, ITA 325, NP 3, WAB 450, BASIMU and PR 2384.10 in descending order. Most grains in the market are weakly aromatic.

Translucency

Translucency is a measure of grain chalkiness. They explain partly the grain production history especially the level of grain moisture at harvest, uniformity of grain at filling and the temperature during grain filling. In this work the above conditions were considered similar except the genetic composition of each grain. Among the varieties tested, variety ITA 257, ITA 325 and Abilony were slightly chalky. Chalkiness is associated with grain tendency to break during milling. However, varieties IRAT 284, WABI 450, SIKAMU, WABI 189 and PR 2384.10 were translucent.

Alkali digestion

It refers to the grains cooking time and amount of water needed, volume for volume for cooking. The varieties IRAT 284, NP3, Abilony and ITA 257 were rated as varieties that require more water for cooking and higher cooking time than the varieties Basimu, WABI 189, PR 2384.10 and WABI 450. The gelatinisation or the grain softness after cooking indicated that the varieties Sikamu, WABI 450, NP3, Abilony, ITA 325 and ITA 257 remained soft.

All the varieties tested had grain qualities similar to what is already in the market.

However, the varieties WABI 450, Abilony, ITA 325, ITA 284 and Sikamu had better

grain qualities than the remaining varieties tested. Farmer preference test is required for the final evaluation.

Descriptive data of IITA 257, IITA 325, WAB 450 & ABILONY IRAT 112)

Characteristics of the 10 upland varieties tested

<i>Variety</i>	<i>Origin</i>	<i>Characteristics</i>	<i>Remarks</i>
ITA 325	IITA	- Aromatic -Early maturity -Bold grain	Earlier tested and selected by farmers in Iganga, Bushenyi, Bundibugyo and Arua.
ITA 257	IITA	-Aroma -Early maturity -Bold grain -Drought tolerant -Resistant to Blast	Earlier tested and selected by farmers in Iganga, Bushenyi, Bundibugyo and Arua.
WAB 189 BBB8 HB	WARDA	-Medium maturity - Round grain	Tested earlier in Iganga and Bugiri
WAB 450 IBP91HB	WARDA	-Median maturity -Long grain -Aromatic	Tested earlier in Iganga and Bugiri
NP 3	Unknown	-Medium maturity -Bold grain	On restricted release since 1995 Dual variety
UK 2	Unknown	-Medium maturity -Bold grain	On restricted release since 1995 Dual variety
NP 4	Unknown	-Medium maturity -Bold grain	Experimental Dual variety
NP 2	Unknown	-Medium maturity -Bold grain	On restricted release since 1995 Dual variety
SIKAMO	Ghana	-Medium maturity -Bold grain	Experimental Swamp variety
ABIONY (IRAT 112)	IRAT	-Medium maturity -Bold grain	Local check Upland variety, released 1996

Agronomic package

Seed rate and spacing: All the three varieties are medium sized grains. Seed rates of 80 Kg/ha are recommended for fine seed beds under line dibbling planting method at (30X5cm) spacing. For rough seed beds or broadcast

Seed rates and Planting methods

Field	Planting method	Seed rate (Kg/ha)
Fine seed bed	Line dibbling	80
Fine seed bed	Broadcast	100
Fine seed bed	OX-plough covering	110
Rough seed bed	Broadcast	110

Fertilizer

The three varieties are fertilizer responsive. The limiting nutrients are Nitrogen and Phosphorus. The amount to be applied depend on fertility of the soil. How long the land has been under cultivation. For a 6 ton per hectare crop 100 kg/ha N and 50 kg/ha P₂O₅. The nitrogen can be applied as Urea, Calcium Ammonium Nitrate(CAN) and Sulphate Amonia. For resource poor farmers corrective application of 50kg/ha N and 30kg/ha P, is necessary.

Application of urea is recommended in split by top dressing at prior to maximum tillering (55 days after planting) and at panicle initiation 65 days after planting. All the P are to be conducted.

Planting time

Both wet and dry planting is recommended. Early dry planting is recommended for adequate moisture capture in the case of the short rains. They can withstand moisture stress up-to panicle initiation stage.

Weeding

Weeding twice is recommended. All weeding must be done before flowering. This is important not only for the economic yield but due to the crops tendency to cause fail to fill due to failure to successfully get fertilized.

Harvesting

Both low-cut (15cm above ground) and high cut 5-10 cm below the panicle are recommended.

Characteristics of promising varieties

Description/Characteristics	Variety			
	IITA257	IITA 325	WAB 450	ABILONY
Tillering ability	11.7 $\pm$ 1.1	13.4 $\pm$ 1	11.6 $\pm$ 1.1	10 $\pm$.9
Culm lodging	No lodging	No lodging	No lodging	No lodging
Panicle exsertion				
Panicle threshability	Well exerted	Well exerted	Well exerted	Moderate
Spikelet sterility	Highly fertile	Highly fertile	Highly fertile	Fertile
Phenotypic acceptability	Goods	Good	Excellent	Fair
Maturity period	125	115	120	98
Grain yield	3600	3370	3517	2700
Leaf length: width ration	32 $\pm$ 1.9	38 $\pm$ 4.5	35 $\pm$ 3.2	33 $\pm$.8
Leaf blade colour	Green	Green	Dark green	Green
Leaf angle	Horizontal	Horizontal	Horizontal	Horizontal
Ligule colour	White	White	White	White
Panicle length (cm)	20.1	23	23	22
Panicle type	Intermediate	Intermediate	Intermediate	Intermediate
Awning	Partly	Absent	Absent	Abilony
Stigma colour	White	White	Yellow	White
Lemma & Palea colour	Gold Furrow	Gold Furrow	Gold Furrow	Gold Furrow
Chalkiness of endosperm	Small	Small	Small	Small

Table 2; Yield in Kgs of 10 Upland rice varieties in 5 Districts in Uganda 2001B

Variety	Palisa		Ran Bugiri		Ran Apac		Ran Lira		Rank Kamwen		Rank	Yield across the country	Average yield RAN K	Farmers Overall rank
IITA325	1348	3	3542	3	4009	3	3320	2	4624	4	3368.6	3	1	
IITA257	1477	2	3614	2	4187	1	3971	1	4748	3	3599.6	2	2	
WAB189	625	8	3333	4	3959	4	3296	6	5190	2	3280.6	4	3	
WAB 450	1481	1	3628	1	4067	2	3508	3	4902	1	3517	1	4	
NP3	783	7	2497	8	3674	5	3042	7	4504	5	2900	7	10	
UK2	1278	5	2877	6	3365	6	2912	5	3916	10	2869.6	6	9	
NP4	421	10	2415	10	3047	10	2768	10	4288	7	2527.8	10	5	
ABILON Y	873	6	2602	7	3108	9	2855	9	4058	9	2699.2	9	8	
SIKAMO	1306	4	2210	9	3359	7	2906	6	4336	6	2823.4	5	7	
NP2	506	9	3038	5	3115	8	2893	7	4194	8	2749.2	8	6	
MEAN	1009.8		2975.6		3713		3147.1		4476		3033.5			
MAX	1481		3628		4187		3971		5190		3599.6			
MIN	421		2115		3047		2768		3916		2527.8			
CV5	13.5		12.3		15.50%		13.5		13.86%					
LSD (0.5)	533.2		796.2		579.2		621.4		785.5					

**PERFORMANCE OF 16 UPLAND RICE VARIETIES UNDER DROUGHT STRESS AND NORMAL CONDITIONS
SEASON 2001 B**

VARIETIES	DAY TO FLOWER		% PRODUCTIVE TILLERS		CULM LENGTH		% REDUCTIO N OF NORMAL	PANICLE LENTH (CM)		% REDUCTIO N FROM NORMAL LENGTH	YIELD (Kg/ha)	
	Under stress	Normal	Under stress	Normal	Under stress (cm)	Normal (cm)		Under stress	Normal		Under stress	Normal
IRAT 233	89.3*	79*	45.3	100	51.1*	79.6	45.9	21.1	24.5*	13.8	756	4831
IDSA-17	80.5	75	49.2	100	39.4*	71.9	45.5	19.3	22.3*	13.4	592	3935
BR-1890-1-1-2	90.3*	80*	9.3	100	49.3*	86*	42.6	19.2	23.6*	18.6	467	4530
WAB 3299	91.7*	78*	2.5*	100	44.2	85.1*	45.2	19.5	24.1*	19	147	4879
IRAT 240	89.2*	77	20.5	100	39.5*	86.1*	54.7	18	23.5*	30	1010	5109
WAB 332	89.2	78*	29	100	46.1	89.7*	48.7	18.2	23.1*	21.1	263	4321
SIKAMO	77.3	73	42	100	41.2*	86.2*	52.2	18.3	25	26.8	1765*	4882
WAB189	96.3*	79*	3.5*		36.2*	81.5	55.6	16.2	27.3*	40.7	275	5215
ABILONY	80.7	74	47.1	100	44.3	79.3	44	22	23	4.3	882	3868
UK 2	78.7	74	42	100	43	72.3	40.1	19.1	22.5*	15.1	952	4935
NP4	87.4*	74	8.9	100	39.5	82.1	51.7	17.2	24.5*	29.8	427	3775
NP2	80.3	73	36.5	100	42.1	79.6	47.1	19.5	23.6*	17.4	1030	3370
NP3	78.3	74	39.3	100	41.3	75.2	45	18	24.1*	25.3	700	3192
MINIMUM	77.3	71	2.5	100	36.2	71.6	35.9	16.2	22.1	0	147	5215
MAXIMUM	96.3	80	75.2	100	53.2	94.3	5.6	23	27.3	40.7	1915	4386.9
MEAN	84.1	75.6	34.9	100	43.6	81	46.18	19.31	23.8		929.4	1473.6
LSD(0.005)	4.1	3.8	41.2	100	3.1	4.1			0.48		878.6	

Abilony Local check; WAB 450 Preferred variety & NP3 restricted release

**PERFORMANCE OF 16 UPLAND RICE VARIETIES UNDER DROUGHT STRESS AND
NORMAL CONDITIONS SEASON 2001B**

Variety	Yield stress	Yield normal	Rank	RGYST	RGYN ORM	Rank
IRAT233	756	4831	10	86.0	110	6
IDSA 17	592	3935	11	67.3	89.7	12
BR-1890-1-1-2	467	4530	12	53.1	103.2	8
WAB 3299	147	4879	16	16.7	111.1	5
IRAT240	1010	5109	6	115.0	116.4	2
WAB332	263	4321	15	30.0	98.5	11
SIKAMA	1765	4882	4	201.0	111.2	4
ITA257	1789	4420	3	203.6	100.7	9
WAB189	275	5215	14	31.3	119	1
WAB450	1915	4536	1	218.0	103.3	8
Abilony	882	3668	8	100.4	88.1	13
ITA 325	1802	4392	2	205.0	100.1	10
UK2	952	3192	7	108.3	72.7	16
NP4	427	4935	13	48.6	112.5	3
NP2	1030	3775	5	117.2	86.0	14
NP3	799	3370	9	91.0	76.8	15
Mean	87.6	4386.9		100	100	
Minimum	147	3192	1	16.7	72.7	
Maximum	1915	5215	16	218	119.0	

Rice Grain Yield under stress: The best variety was WAB 450 with 218% of the mean, ITA 325 with 205 %, ITA 257 with 203.6 % and Sikamo, 201%. WABI 189 the best performer under normal conditions and across site had a relative grain yield of 31.3 % of the trial mean.

When the mean yield across the two environments for each variety was computed yields of 60.6 % ;56.15, 52.5 %, 52.1 and 15.7 % above the trial mean was observed for WAB 450, Sikamo, ITA 325, ITA 257 and IRAT 240

**Performance of promising upland rice varieties in East and Western
part of Uganda -2002A(Yield in Kg/ha).**

Variety	West	East	Mean across
WAB 450	750	1227	989
ITA257	645	1353	980
WAB189	925	872	714
ITA325	987	1017	1002
ABILONY	783	1044	913
>0.05	ns	ns	

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Your Ref:

Our Ref.

May 16, 2002

Dr. Justus Imanywoha,
NAARI
P.O Box 7084,
Kampala

Dear Dr. Imanywoha,

Re: Results for Rice Laboratory Grain Quality Testing

Please find attached laboratory results for rice quality. After threshing, we got smaller quantities of each sample, which could not enable us carry out all the tests requested for. Next time, kindly supply us threshed rice and in quantities of at least 3 kg each sample.

Thank you.

Yours faithfully,

Archileo N. Kaaya
Lecturer

RESULTS OF RICE LABORATORY GRAIN QUALITY TESTING

Sample/ code	Alkali digestion	Gelatinization	Volume expansion	Aroma	Grain appearance
1 IRAR 284	High	High	1.0	Lightly	Round
2 ITA 257	Interm.	Interm.	1.0	Lightly	Round
3 ITA 325	Interm.	Interm.	1.31	Lightly	Round
5 Abilony	Interm.	Interm.	0.88	Non scented	Slender
NP3	Interm.	Interm.	2.29	Lightly	Slender
3 WAB 450	Low	Interm.	0.67	Lightly	Slender
6 SIKAMU	High	Low	0.97	Non scented	Round
BASIMU	Low	High	1.5	???	Slender
4 WAB 189	Low	High	1.83	Non scented	Slender
PR 2384.10	Low	High	1.73	Scented	Slender

RESULTS FOR TRANSLUCENCY

Sample code	Scale		
	White belly	White centre	White back
IRAR 284	9 (32%)	9 (30%) λ	9 (38%)
ITA 257	5 (18%)	5 (12%) $\checkmark$	9 (70%)
ITA 325	9 (28%)	5 (12%) $\checkmark$	9 (60%)
Abilony	9 (40%)	1 (10%) $\checkmark$	9 (50%)
WAB 450	9 (28%)	5 (18%)	9 (54%)
Sikamu	9 (46%)	9 (22%) $\times$	9 (32%)
WAB 189	9 (38%)	9 (26%) $\times$	9 (36%)
PR 2384.10	9 (44%)	5 (18%) $\downarrow$	9 (38%)