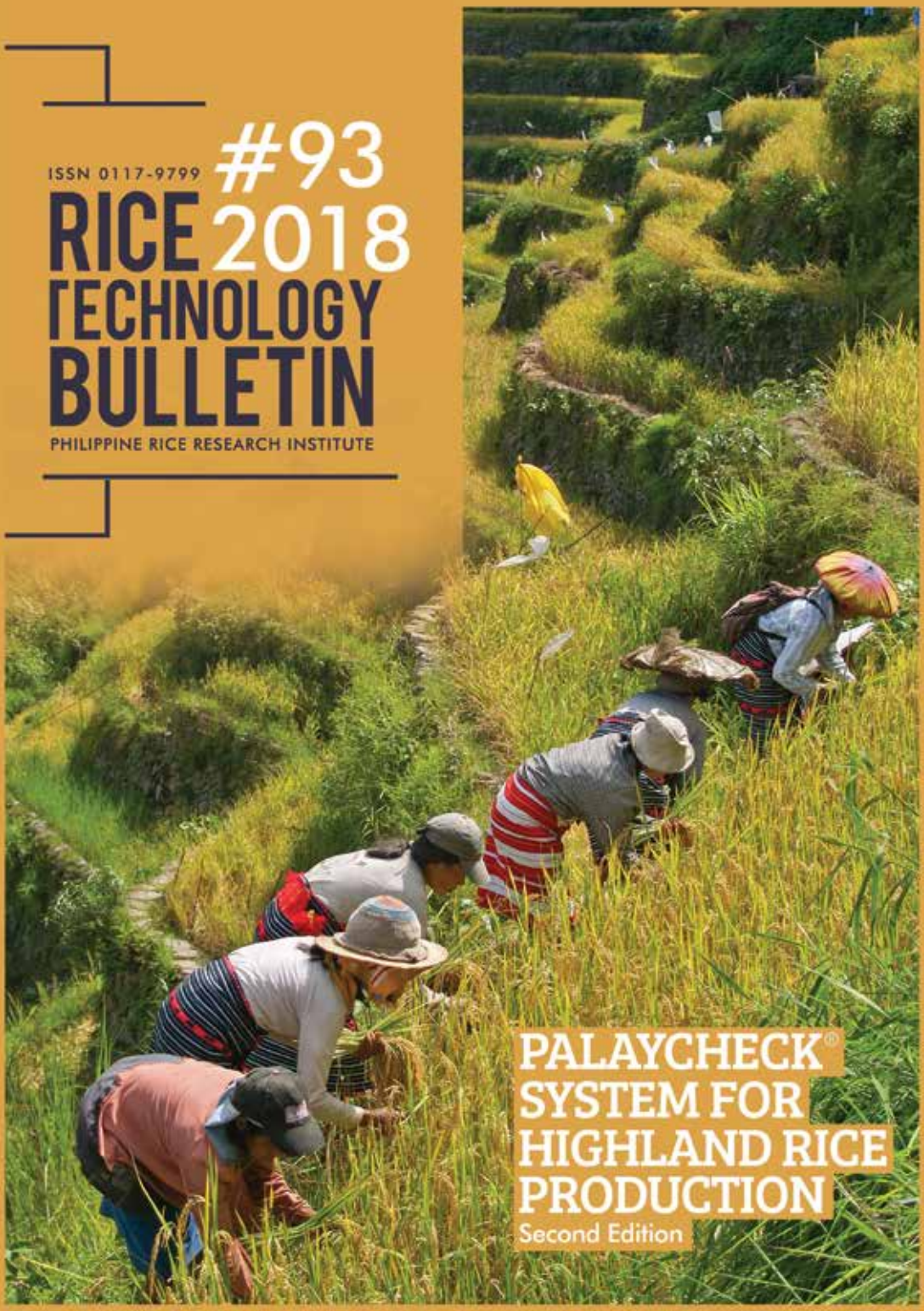


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#93 RICE 2018 TECHNOLOGY BULLETIN

PHILIPPINE RICE RESEARCH INSTITUTE



**PALAYCHECK®
SYSTEM FOR
HIGHLAND RICE
PRODUCTION**

Second Edition

Rice Technology Bulletin Series

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FOREWORD

Heirloom rice, passed down through family generations, is normally grown on small family farms in certain areas of Mindanao and the Cordillera Administrative Region. Commonly planted by subsistence families in highland or cool-elevated farms, heirloom rice is their staple food and cultivating it has become their way of life.

These rice cultivars command higher prices in niche markets locally and internationally. However, the huge potential of heirloom rice as a lucrative source of livelihood is being stymied by the inability of local farmers to increase their current yields of 2.0 to 3.5 t/ha. Rice sufficiency needs to be ensured in heirloom farming communities before they can go after producing marketable surplus for added income.

The Department of Agriculture (DA) implemented the Heirloom Rice Project in partnership with PhilRice and the International Rice Research Institute. The project aimed to enhance the productivity and enrich the legacy of heirloom or traditional rice by empowering communities that plant them in unfavorable rice-based ecosystems.

This bulletin documents PalayCheck, an integrated crop management system for highland organic rice production by consolidating the best farming practices in the project's participating communities.

The heirloom rice team hopes that through this bulletin, we can enhance on-farm conservation of farmer-preferred (heirloom/traditional and climate-resilient) varieties to improve farm productivity through the sustained availability of high-quality seeds. We believe that adding value to every segment of the value chain—from varietal development to market linkages—will benefit the heirloom rice farmers in the long term.



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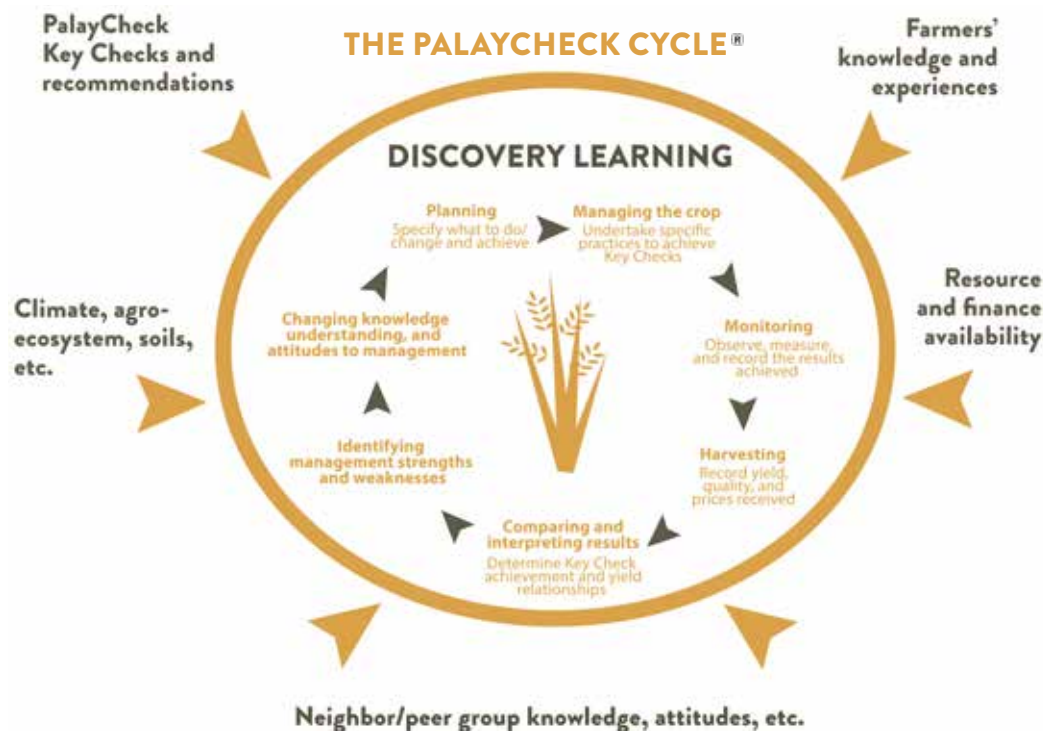


WHAT IS HEIRLOOM RICE?

It refers to a collection of traditional rice cultivars passed down through generations in highland or cool-elevated areas. Normally grown on small family farms, these rice varieties are highly in demand locally and internationally owing to their exceptional cooking quality, flavor, aroma, texture, color, and nutritional value. Heirloom rice varieties are usually resistant to biotic and abiotic stresses.

WHAT IS PALAYCHECK[®]?

It is an integrated crop management system for rice that provides recommendations on what to do and what to achieve based on the best management practices in a particular agro-ecological condition, in this case, the heirloom farming communities in highland areas. It seeks to adapt these recommendations at the farm-level, taking into account the interactions among management practices and other factors affecting yield, grain quality, and the environment.



KEY CHECK 1

Used high-quality seeds of heirloom rice varieties



Characteristics of high-quality seeds:

- Relatively pure
- Clean
- Full & uniform in size
- Have minimum germination rate of 85%

Advantages of using high-quality seeds

- Healthy, fast, and uniform growth resulting in efficient crop establishment and harvesting activities
- Less weeds
- Resilient to climate change
- Resistant to major pests and diseases

Recommendations

- Select and harvest panicles that are disease-free, full, mature, and of the same variety for seeds.



- Bind in smaller bundles for easier and uniform drying.



- Gradually dry and store hermetically, in seed bank, or individual granary (Alang) that are free from rodents, insects, and at 12% moisture content.



KEY CHECK 2

Prepared fields on time with no high and low soil spots after final leveling

Assessment

- During land leveling, the field must have shallow water at 2-5cm.
- The field should have no visible mound of soil above the water surface after the final leveling.

Advantages of a leveled field

- Allows faster and uniform water distribution
- Reduces weed incidence
- Allows better management of golden apple snails
- Helps achieve a uniform crop maturity

Recommendations

- Repair dikes, ripraps, and canals for easier and efficient irrigation.
- Clean stonewalls and bunds to eradicate the shelter of pests.
- Incorporate weeds, rice straws, and stubbles in the field using a microtiller, animal-drawn implements, or manual trampling at least 2-4 weeks before planting for proper decomposition.
- Lower water depth at 2-5cm. Level the field using animal-drawn leveler, or manually-drawn wooden plank or banana trunk a day before transplanting.



Leveling field using wooden plank

KEY CHECK 3

Practiced synchronous planting after a fallow period



Assessment

- Field must be planted within 2 weeks before and after the majority of neighboring terraces or cluster area has been planted.
- Allow fallow period of 4-6 weeks from harvest to establishment of the next crop.

Advantages of synchronous planting

- Avoids the overlapping incidence of insect and disease populations.
- A fallow period of 4-6 weeks breaks the insect pest cycle, destroys disease hosts, and provides ample time for decomposition.

Recommendations

- Allow a fallow period of 4-6 weeks from harvest to establishment of the next crop.
- Strengthen the “bayanihan” system (*alluyon* for Kibungan, *ob-obbo* for Bauko, *afuyog* for Barlig and Lubuagan, *ubbu* for Banaue and Hungduan, *ab-abvuyog* for Pasil) to ensure sufficient manpower for easier and faster transplanting activities.

KEY CHECK 4

Ensured sufficient number of healthy seedlings

Assessment

- After replanting missing hills within 7 days after transplanting (DAT), assess the hill density and health status of seedlings at 10 DAT. Randomly select 3 sampling locations at least 1m from the levee and in a diagonal line across the field. Count the hills from each location using a 1m x 1m quadrat. Add the counts and divide it by 3 to get the average. There should be at least 25 hills/m².
- Each hill should have at least 2 healthy seedlings. A healthy seedling is green with good growth and free from pest and diseases.

Advantages of healthy seedlings

- Compete better against weeds
- Have better root growth necessary for better nutrient intake
- Ensure sufficient number of healthy seedlings at optimum cropping density to help achieve higher yield



Seed soaking in bundles



This process may infect seeds with diseases from previous cropping, hence it is not recommended.

Recommendations

Seed soaking and incubation

- Soak panicle bundles or grains in clean water for 24-36 hours.
- Incubate by covering with sack in shaded area for another 24-36 hours. Keep it moist and aerated.



Seedbed preparation

- Prepare raised seedbed 2-4 weeks before sowing.
- Puddle the soil and incorporate weeds, rice straws, and stubbles.
- For dry season cropping (January to June), use the wet bed method in raising seedlings and construct canalets as drainage for excess water.
- For wet season cropping (July to December), rotavate the soil well and use the dry bed method in raising seedlings.



Sowing

- Wet bed: For a 1000-m² production area, lay pre-germinated panicles (approximately 6kg when threshed) uniformly at 3-5in interval between panicles, or broadcast 6kg pre-germinated seeds in 60-m² seedbed area.
- Dry bed: For a 1000-m² production area, broadcast 6kg pre-germinated seeds evenly in 60-m² raised seedbed. Cover seeds either with fine soil, rice straw or ash.

Care of seedlings

- Wet bed: Keep the soil saturated within 5-7 days after sowing; Increase and maintain water level to 2cm until seedling pulling
- Dry bed: Keep the soil saturated until seedling pulling

Transplanting

- Transplant 35 to 45 days old seedlings.
- Use 2-3 seedlings per hill at 20x20cm spacing.
- Replant missing hills within 7 days after transplanting.

KEY CHECK 5

Ensured sufficient plant nutrients at critical stages of the crop

Assessment

- At ripening phase, assess the panicle density. Randomly select 3 sampling locations at least 1m from the levee and in a diagonal line across the field. Count the panicles from each location using a 1m x 1m quadrat. Add the number of the panicles and divide by 3 to get the average. There should be at least 100 panicles/m² (at an average of 120 filled grains per panicle) to attain a target yield of at least 3t/ha.

Advantage

- The availability of essential plant nutrients in the soil, coupled with good crop management, assures a healthy and productive crop. Attaining the target yield can be a good indicator of the availability of elements necessary for plant growth.

Recommendations

- Conduct soil analysis such as Minus One Element Technique (MOET) to determine nutrient deficiencies.
- Incorporate well to the soil weeds, rice straws, stubbles, sunflower leaves, and other organic materials.
- Construct compost piles for proper decomposition of crop residues and other organic matters before field application.

MOET set-up



KEY CHECK 6

No excessive water or drought stress that could affect the growth and yield of the rice crop

Assessment

- No symptoms of stress, such as reduced tillering and leaf area owing to excessive water (exceeding 5 cm depth for 7 days or more) at vegetative phase.
- No symptoms of drought stress, such as leaf rolling; leaf tip drying; reduced leaf area, height, tiller number and panicle exertion; and many unfilled or partially-filled grains at vegetative and from panicle initiation to grain filling.

Advantages

- Water transports nutrients from the soil to the plant and serves as raw materials in photosynthesis. An adequate water supply ensures good crop establishment, seedling vigor, normal crop growth, development, and yield.

Recommendations

- Construct drainage canals to drain excessive water.
- Maintain shallow water depth at 2-3cm during vegetative phase and 3-5cm during reproductive phase
- Practice Alternate Wetting and Drying Method if possible. Construct canalets surrounding the paddy to facilitate the draining of field up to saturated level.
- Drain water or stop irrigation 1-2 weeks before harvest.



KEY CHECK 7

No significant yield loss due to pests



Assessment

- No significant yield loss owing to insect pests, diseases, weeds, rats, snails, and birds. Significant yield loss occurs when one or more pests cause significant damages.

Advantages

- Interactions of the rice crop with the biotic factors, agroecosystem, and crop management system provide an accurate understanding of the destructive potential of pests.
- Correct pest identification, disease diagnosis, and application of integrated crop management technologies are needed for successful pest management.

Recommendations

- Conduct regular field monitoring, sanitation, and correct diagnosis help prevent the spread of diseases.
- Interactions of the rice crop with the biotic factors, agro-ecosystem, and the crop management system help in understanding how to minimize pest damage.

Table 1 - Damage Level Associated with Significant Yield Loss

	Significant Pest Damage
Rats	5% or more of the area has damaged tillers from maximum tillering to maturity
Snails	10% or more of the area has missing or snail-damaged hills at 14 DAT
Weeds	10% or more of the area has weeds at 15 and/or 30 DAT
Birds	5% or more of the area has damaged panicles

Table 2 - Insect Level Associated with Significant Yield Loss

Growth Stage	Insect Pests			
	Stem borer	Rice Black Bug	Brown or White Back Plant Hopper	Rice Bug
Nursery/ Seed bed	5 eggmasses/m ²	none	none	none
Early Tillering	30% deadheart	≥ 10 (nymph & adult) and ≥ 20% whitehead	≥ 25 all stages of insects/ hill	none
Mid to maximum tillering – P.I.	1 eggmass/m ²	≥ 20 (nymph & adult) and ≥ 30% whitehead	≥ 50 all stages of insects/ hill	none
Flowering	≥ 20% whitehead	≥ 20 (nymph & adult) and ≥ 20% whitehead	≥ 50 all stages of insects/ hill	Negligible
Milk Stage	≥ 20% whitehead	≥ 20 (nymph & adult) and ≥ 20% whitehead	Tolerable	≥ 5 (nymph and adult)/m ²
Grain Filling	≥ 20% whitehead	≥ 20 (nymph & adult) and ≥ 20%	Tolerable	≥ 5 (nymph and adult)/m ²
Maturity	≥ 20% whitehead	≥ 20% whitehead	Tolerable	Tolerable

Table 3 - Disease Level Associated with Significant Yield Loss

Growth Stage	Diseases			
	Brown Spot (BS)	Leaf and/or Panicle Blast	Sheath Blight (SHB)	Bacterial Leaf Blight
Nursery/ Seed bed	none	≥ 20% of seedbed has leaf blast	none	Negligible
Early Tillering	≥ 30% of the field infected with BS	≥ 20% of the field infected with leaf blast	Negligible	Negligible
Mid to maximum tillering – P.I.	≥ 50% of the field infected with BS seen on leaves	≥ 30% of the field with leaf blast	≥ 40% of the field infested with SHB	≥ 30% of the field infected with BLB
Flowering	≥ 50% of the field crop infected with BS seen on flag leaf	≥ 10% of the field infected with neck blast	≥ 40% of the field infested with SHB seen on flag leaves	≥ 30% of the field infected with BLB seen on flag leaves
Milk Stage	≥ 50% of the field infected with BS seen on flag leaves and spikelets	≥ 10% of the field infected with panicle blast	≥ 40% of the field infected with SHB seen on spikelets	≥ 30% of the field infected with BLB and with under-developed spikelets
Grain Filling	10% unfilled grains	≥ 10% of the field infected with panicle blast	≥ 40% of the field infected with SHB and > 10% of unfilled grains	≥ 30% of the field infected with BLB and with under-developed spikelets
Maturity	10% unfilled grains	≥ 10% of the field infected with panicle blast	≥ 40% of the field infected with SHB and > 10% of unfilled grains	≥ 30% of the field infected with BLB and with under-developed spikelets

KEY CHECK 8

Harvest the crop at the right time



Assessment

- Harvest the crop when 90-95% of the grains in the panicle are fully ripened (for shattering varieties), and can be allowed to ripen up to 95-100% (for non-shattering varieties).
- If stored in grains, harvest should be threshed and dried immediately within 1 day (during the wet season) or 2 days (during the dry season) after harvesting.

Advantages

- Timely harvesting and proper drying ensure good grain quality, high market value, and consumer acceptance.

Recommendations

- Harvest fully matured panicles using “lakem/lokom/gamulang”.
- Bind and air dry the panicles not later than 1 day after harvest.
- Continue drying the panicles or threshed grains up to 14% MC for milling and 12% MC for seeds purposes. Drying should be done gradually.
- Store bundled panicles in “Alang” and threshed grains in tightly sealed containers, free from rodents, birds, insects, and moisture.

LIST OF POPULAR HEIRLOOM RICE VARIETIES (2014-2016)

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
Amganad, Banaue, Ifugao					
Innawi awn	188	171.50	4	White, non-glutinous, aromatic	3.30
Balikwadang	188	150.40	7	Red, glutinous	1.50
In-ngudpur	197	147.80	6	Red, glutinous	1.30
Color	210	124.20	10	Black, glutinous	2.50
Vallahang	197	163.80	7	White, non-glutinous, aromatic	2.50
Innawi long awn	188	171.20	7	White, non-glutinous	3.50
Bukig	210	150.00	7	White, non-glutinous	1.30
Kamanga	188	177.00	4	Red, non-glutinous, aromatic	1.20
Imbuuan	188	174.35	7	White, non-glutinous, aromatic	2.00
Donaal	188	161.13	5	White, non-glutinous, aromatic	3.90
Minaangan	210	139.20	6	Red, non-glutinous	2.10
Pinidwa White	197	150.00	11	White, non-glutinous	2.42
Balatoc, Pasil, Kalinga					
Camuros	160	125.00	3	White, aromatic	2.86
Walay	160	107.30	3	White, glutinous, aromatic	2.98

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
Mad-an	160	105.30	3	Long awned, red, glutinous	2.59
Ulikan	172	121.00	5	Red	3.07
Inib-Ay	160	110.70	4	White	1.92
Unoy Chong-Ak	155	121.70	3	Red, aromatic	2.15
Yonga	155	103.60	3	Short awned, purple violet, glutinous	2.04
Unoy Ifuwan	160	133.00	4	Red, aromatic, with awn	2.61

Bauko, Mountain Province

Gilgilang	144	118.00	5	Red	3.28
Lad-okan	145	114.00	6	White	2.81
Balatinao	157	121.00	5	Short awned, aromatic, black/purple, glutinous	3.05
Kalaw	152	122.00	5	White	2.94
Lopog	159	123.00	4	Long awned, reddish purple	2.67
Makalaniag	162	126.50	4	Long awned, white	2.70
Tangkaw	148	123.50	4	Medium awned, white	2.88
Wadingan	154	126.00	4	Long awned, white	2.84

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
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Dangtalan, Pasil, Kalinga

Alig	155	98.00	5	Red, glutinous, aromatic	2.51
Yonga	155	103.60	3	Purple violet, glutinous	2.15
Ulikan	165	94.30	3	Red	2.81
Lapoy (Unoy)	155	105.33	4	Short awned, pink, aromatic, glutinous	2.90
Unoy Chong-Ak	155	103.00	4	Red, aromatic	2.62
Oltan White	165	105.60	6	White	3.04
Waray	160	106.60	4	White, aromatic	3.10

Hapao, Hungduan, Ifugao

Minaangan Layyag	193	129.60	4	Red, non-glutinous	3.90
Minaangan Ahukbaba 1st	200	95.80	3	Red, non-glutinous	3.67
Minaangan Ahukbaba 2nd	200	100.80	3	Red, non-glutinous	3.00
Minaangan Ahukbaba 3rd	200	121.80	7	Red, non-glutinous	3.17
Minaangan with long awn	200	119.20	6	Red, non-glutinous	3.70
Minaangan In-upong with long awn	200	126.80	4	Red, non-glutinous	3.00

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
White without awn	200	99.40	4	Red, non-glutinous	3.65
Layyag White without awn	193	131.20	4	Red, non-glutinous	3.17
Kadaclan, Barlig, Mt. Province					
Akangan White	189	140.00	6	White, non-glutinous	3.01
Akangan Red	189	139.00	6	Red, non-glutinous	3.32
Pinawid	180	115.00	6	White, non-glutinous	3.08
Finggawan	180	104.20	10	White, non-glutinous	2.24
Sayong	189	130.40	5	White, non-glutinous, aromatic	3.09
Yomarin	180	131.40	10	White, glutinous	2.26
Lamadya Red	180	96.40	5	Red, non-glutinous, aromatic	2.73
Ramenad	189	125.90	9	White, non-glutinous	2.96
Fianguwan	189	115.60	4	White, non-glutinous, aromatic	2.92
Ominio	180	124.20	8	Violet, glutinous	2.96

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
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Lubuagan, Kalinga

Unoy Lapoy	160	105.67	3	Short awned, pink, aromatic, glutinous	1.70
Ulukan Red	172	102.67	7	Red	3.15
Chumalingan Red	160	101.27	4	White, aromatic	2.67
Allugit	172	125.83	8	Short awned, violet, glutinous, aromatic	3.08
Walay	172	100.33	3	White, glutinous, aromatic	2.80
Tilopong	160	96.67	5	Red, glutinous, aromatic	2.69
Unoy Suggo	160	98.33	4	Red, aromatic	2.08

Palina, Kibungan, Benguet

Lablabi	162	128.00	5	Long awned, aromatic, red	2.75
Lasbakan	158	114.00	6	Long awned, aromatic, red	2.90
Bongkitan	168	110.00	4	Aromatic, white, glutinous	2.98
Balatinaw	166	119.00	5	Short awned, aromatic, black/purple, glutinous	3.05
Gaygad	174	115.00	4	Aromatic, white	2.85
Lamadya	172	114.00	4	Aromatic, white	3.13

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
Kalinga	150	113.00	6	Red rice	3.34
Diket (Hungduan)	145	104.00	5	Aromatic, red, glutinous	2.59
Poblacion, Kibungan, Benguet					
Bongkitan	164	132.00	5	Aromatic, white, glutinous	2.96
Balatinaw	160	124.50	6	Short awned, aromatic, black/purple, glutinous	3.12
Lasbaken 1	152	127.00	5	Long awned, aromatic, red	2.97
Lasbaken 2	152	130.00	5	Long awned, aromatic, red	2.89
Lablabi	159	131.00	5	Long awned, aromatic, red	2.77
Lamadya	161	118.00	6	Short awned, aromatic, white	3.15
Gal-ong	150	132.00	4	Aromatic, red	2.38
Talokitok	164	130.00	5	Aromatic, white	2.99
Kalipago	146	116.00	4	Long awned, aromatic, red	2.49
Malonos	154	110.50	5	Aromatic, white	2.93
Kamporo	160	115.60	5	Aromatic, white	2.83

Variety	Maturity	Average plant height (cm)	Average number of productive tillers	Grain characteristics	Actual yield (t/ha)
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Poblacion, Kibungan, Benguet

Bongkitan	164	132.00	5	Aromatic, white, glutinous	2.96
Balatinaw	160	124.50	6	Short awned, aromatic, black/purple, glutinous	3.12
Lasbaken 1	152	127.00	5	Long awned, aromatic, red	2.97
Lasbaken 2	152	130.00	5	Long awned, aromatic, red	2.89
Lablabi	159	131.00	5	Long awned, aromatic, red	2.77

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We are a chartered government corporate entity (Classification E) under the Department of Agriculture. We were created through Executive Order 1061 on 5 November 1985 (as amended) to help develop high-yielding, cost-reducing, and environment- friendly technologies so farmers can produce enough rice for all Filipinos. With a "Rice-Secure Philippines" vision, we want the Filipino rice farmers and the Philippine rice industry to be more competitive through research for development (R4D) work in our central and seven branch stations, coordinating with a network that comprises 60 agencies strategically located nationwide. We have the following certifications: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environmental Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

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