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Study of Potential Availability and Need for Quality Paddy Seeds In Supporting Paddy Production / Productivity in West Java

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Abstract. Paddy is a major and strategic commodity for most of Indonesia's population. As a staple food raw material, its availability must always be sufficient along with the population growth. One of the important production facilities in supporting paddy production is quality paddy seeds whose role is very decisive in efforts to improve grain quality, production and productivity. This study aims to: 1) identify the potential of paddy fields and paddy production and 2) analyze the needs and availability of paddy seeds in West Java. Using time series secondary data and analyzed descriptively exploratively is an analytical method that aims to describe the state of a phenomenon or describe the existence of a variable, symptom or condition. The results of the study showed that the potential of paddy fields in West Java averaged 748,012.40 hectares or 80.25 percent of the area of agricultural land. Paddy production in West Java averages 11,617,793 tons per year. During 2011-2016, paddy production experienced a negative growth of an average of 0.08 percent per year and field paddy production experienced an average positive growth of 4.6 percent per year. Availability of paddy seeds in West Java on average: a) FS as many as 950.91 tons per year, b) SS 11,595.67 tons per year, and c) ES as much as 28,737.58 tons per year. While the need for paddy seeds in West Java is assumed to be 23,302.20 tons per year. Results of paddy seed surplus / deficit calculation If it occurs every year, paddy seed production has a deficit..

Keyword: Production, quality paddy seeds, West Java

1. Introduction

Paddy (*oryza sativa*) is a major and strategic commodity for the population of Indonesia. As well as being a staple food for more than 95 percent of Indonesia's population, Paddy has also provided employment for around 20 million rural farm households [8]. Until now, West Java Province has contributed greatly to national paddy production, on average contributing around 22 percent per year with paddy production averaging 11,617,793 tons per year [1,9]. The 80 percent of Paddy is produced from paddy fields and the rest from non-Paddy fields.

Paddy as a staple food raw material availability must continue to be sufficient from time to time. And therefore it must be supported by good, correct and efficient methods of farming to produce high levels of paddy production / productivity. The main needs in paddy farming include seeds. Paddy seeds have a very decisive role in efforts to increase production and quality of grain products. Seeds are the main determinant of productivity. Seed quality will determine the applied quality of



technology and management. No matter how high the fertilizer dosage is, if the seeds used are not superior seeds that are responsive to fertilizers, then only a small portion of fertilizer is absorbed by plants, damages soil structure, and wastes agricultural medicines [10], low, the results will be low [8,11]. The use of quality seeds can reduce the risk of cultivation failure [12].

Seeing its very important role, the availability of quality paddy seeds in an area should be sufficient to meet the paddy planting needs in each season. With an average land area of 932 thousand hectares of agricultural land, among them are irrigated paddy fields covering an area of 748 thousand hectares, it is estimated that 23.436 tons of paddy are needed per year. This study aims to: 1) identify the potential of paddy fields and paddy production and 2) analyze the needs and availability of paddy seeds in West Java.

2. Materials and Methods

Study of Potential Availability and Need for Quality Paddy Seeds in Supporting Paddy Production / Productivity in West Java is carried out using secondary time series Central Statistics Agency (BPS) data covering agricultural land data, Paddy production and Food Crop and Horticulture Supervision and Certification Centers (BPSBTPH) West Java Province, including data on paddy hatchery area, production and productivity of paddy seeds. In addition, scientific articles on paddy seedling were used and field observations were carried out on the characteristics of captive breeding in several paddy seed production centers in Subang and Cianjur regencies which included characteristics: 1) land area owned by breeders, 2) status of cultivation land, 3) reasons for producing seeds paddy, 4) class of seeds produced, 5) marketing of paddy seeds, and 6) paddy seed consumers. Data is then analyzed descriptively exploratively aimed at describing the state of a phenomenon or describing the existence of a variable, symptom or condition [13].

3. Results And Discussion

3.1. Potential of Rice Fields and Rice Production

West Java has an average farm area of 932,088 hectares consisting of irrigated rice fields covering an area of 748,012.40 hectares (80.25%) and non-paddy fields with an area of 184,075.40 hectares (19.75%). During 2012-2016, irrigated rice fields in West Java continued to decline from 756,757 hectares to 736,635 hectares.

Table 1. Paddy Field Area of West Java, 2011-2015

Land type	2012	2013	2014	2015	2016	Rata-rata
a. Irrigated Rice Fields (ha)	756,757	748,604	749,033	749,033	736,635	748,012.40
b. Non-Rice Fields (Rainfed, Lebak, Tidal, Polder and others) (ha)	181,301	187,925	187,496	187,496	176,159	184,075.40
Jumlah (ha)	938,058	936,529	936,529	936,529	912,794	932,088
a. Irrigated Rice Fields (ha)	80.67	79.93	79.98	79.98	80.70	80.25
b. Non-Rice Fields (Rainfed, Lebak, Tidal, Polder and others) (ha)	19.33	20.07	20.02	20.02	19.30	19.75
Jumlah (%)	100.00	100.00	100.00	100.00	100.00	100.00

Source: [1] (processed)

The decrease in paddy field area occurred in urban areas, averaging 0.028 percent. On the other hand, the area of paddy fields in the Regency area grows positively by an average of 0.002 percent. Several regency / city that have decreased paddy fields include Bogor Regency (0.009%), Sukabumi (0.002%), Garut (0.018%), Ciamis (0.410%), Majalengka (0.006%) and Bekasi (0.005%). While the city includes Bogor (0.008%) Sukabumi (0.004%), Bandung (0.009%), Cirebon (0,000), Depok (0.012%) (Bappeda of West Java Province, 2017). The decline in paddy fields will require consequences of intensification in rice cultivation, so that the planned production targets can be achieved and even increased. One of the intensifications can be done by presenting quality rice seed technology that is adaptive and has high yield / productivity potential.

3.2. Potential of Paddy Production

West Java paddy production averages 11,617,793 tons per year consisting of 11,077,922 tons per year of paddy “sawah” and 539,871 tons per year of paddy “ladang”. During 2011-2016, paddy “sawah” production experienced a negative growth of an average of 0.08 percent per year whereas in the paddy “ladang” production in 2011-2016 experienced positive growth on average by 4.6 percent per year. The decline in paddy production has been going on for a long time, during 1993-2003 it fell to 0.83 percent per year [14]. In the production center Indramayu District paddy, during 2001-2008 the average decline in paddy production reached 1 million tons per year, even in 2006 the decline was very sharp [15]. The decrease in production was caused by several things such as changes in temperature and rainfall, the most severe impact of El Nino [1], and a decrease in harvested area of 6.17 percent [1]

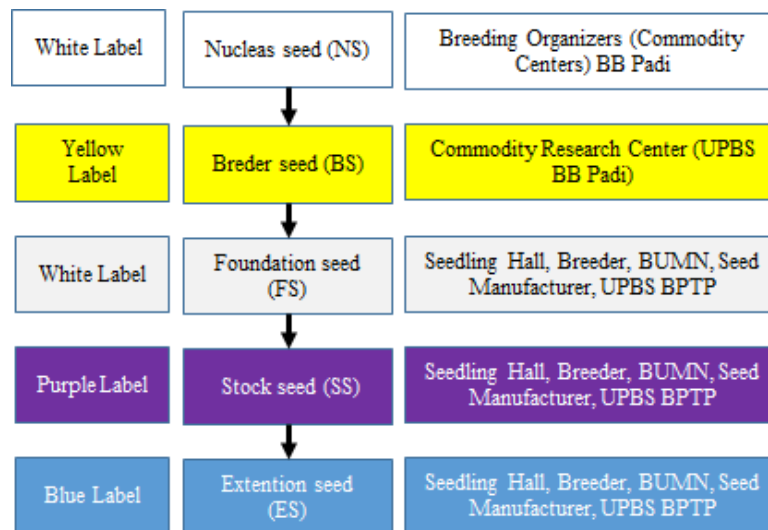
Table 2. Rice Production Trends in West Java Province 2011-2016

Commodity	2011	2012	2013	2014	2015	2016	Average
A. Production							
▪ Paddy “Sawah” (ton)	11,180,652	10,753,612	11,568,472	11,085,544	10,896,438	11,085,544	11,077,922
▪ Paddy “Ladang” (ton)	452,239	518,249	545,688	559,355	516,706	559,355	539,871
Jumlah (ton)	11,632,891	11,271,861	12,114,160	11,644,899	11,413,144	11,644,899	11,617,793
B. Pertumbuhan							
▪ Paddy “Sawah” (%)		(3.82)	7.58	(4.17)	(1.71)	1.74	(0.08)
▪ Paddy “Ladang” (%)		14.60	5.29	2.50	(7.62)	8.25	4.60

Source: [1] (processed)

3.3. Land Area and Paddy Seed Production

Based on the hierarchy of paddy seed consists of: 1) Nucleas seed (NS) is the seed of the White Label, 2) Breder seed (BS) is the seed of the Yellow Label, 3) Foundation seed (FS) is the seed Label White, 4) Stock seed (SS) is the seed of the Purple Label, and 5) Extention seed (ES) is the seed of the Blue Label. Paddy seeds produced in West Java include paddy seeds in the BS, FS, SS, and ES classes. BS class paddy seeds produced on an area of 1.40 hectares with a production of 1.83 tons are paddy seeds that will be propagated into FS class paddy seeds, FS class paddy seeds are multiplied into SS class paddy seeds, then SS class paddy seeds are propagated into ES class paddy seeds. The ES class paddy seeds are the most produced because they will be used directly to produce consumption grain. ES class seeds should not be used to produce lower or equal seed classes, but only for consumption purposes [3].



Source: [2]

Figure 1. Hierarchy of Seed Classes and Seed Propagation Flow

During 2008-2017 ES class paddy seeds were produced on an area of 12,568.54 hectares with an average production of 28,737.58 tons per year. Table 3 shows that paddy seed production fluctuates, this is caused by several things: 1) paddy seed is produced mostly because it is based on consumer orders (distributors), so the number and class of paddy seeds produced are highly dependent on demand, 2) uptake of the use of new paddy seeds in each planting season is still low. The average use of seeds is only done after 2 (two) even more planting seasons, and 3) there are still many uses of local seeds / own production seeds that have adaptation and productivity that are not much different from certified paddy seeds marketed at farm stalls. The use of local seeds / self-seed production is often associated with the fanaticism of farmers who believe more in information and experience of fellow farmers, or on the results that have been felt. Nugraha and Sayaka [4] state that farmers generally use the price of stocking grain in assessing seed prices. If the difference in grain prices and seed prices is too large, and farmers have not obtained convincing evidence about the superiority of seed quality of a variety, then farmers will be very careful to buy the seeds.

Table 3. Land Area of Paddy Seed Production in West Java, 2008-2017

Year	FS		SS		ES	
	Scale (ha)	Production (ton)	Scale (ha)	Production (ton)	Scale (ha)	Production (ton)
2008	174.486	492.39	3,367.09	4,903.76	15,684.94	37,431.77
2009	210.690	653.39	2,035.54	2,963.34	14,171.57	39,596.94
2010	307.106	520.45	3,701.02	4,818.60	16,762.46	39,762.46
2011	233.941	1,015.60	2,906.12	6,596.49	15,141.98	46,489.54
2012	445.490	1,110.05	4,098.81	8,313.97	19,221.02	48,219.77
2013	437.880	657.61	6,845.51	12,046.06	14,928.13	20,534.44
2014	276.770	812.76	6,810.31	15,140.19	6,099.34	7,841.33
2015	332.350	1,173.69	7,473.65	17,894.47	6,776.17	11,876.31
2016	564	1,735.66	10,864.30	27,170.50	10,778.03	21,782.10
2017	396	1,337.47	6,773.93	16,109.31	6,121.80	13,841.17
Average	411.60	950.91	5,487.63	11,595.67	12,568.54	28,737.58

Source: [5] (processed)

West Java paddy seed production has not been accompanied by high seed productivity. If you see the potential for paddy consumption on average above 5.8-6 tons per hectare, paddy seed productivity still relatively low. The laboratory test results for the potential of FS class paddy seed production were only 3.01 tons per hectare, SS class paddy seeds were 1.92 tons per hectare, and ES class paddy seeds were 2.18 tons per hectare [5]. This condition is in line with the opinion of [4] that the efficiency of certified seed production is still low. The ratio between the volume of seeds passed the laboratory test and the planting area passed the field inspection is very low and varied. For ES class paddy seeds, the field inspection graduation was only 78-86 percent and laboratory tests were 73-99 percent [60].

3.4. Institutional Production and Marketing of Paddy Seeds

In West Java there is a paddy seed production institution that functions to carry out rice seed propagation based on its authority (Table 4). Paddy seed breeding activities are held in 18 regencies / cities and carried out by as many as 199 breeders with a potential of captive land of 13,870 ha per year and potential paddy seed candidates produced by 56,232 tons per year.

Table 4. Paddy Seed Institution in West Java

Institutional	Function	Product
1) Center for Rice Research (BB Padi)	Provision of Breeder seed (BS)	Breeder seed (BS)
2) Balai Pengkajian Teknologi Pertanian (BPTP) Jawa Barat	<ul style="list-style-type: none"> Provision of Foundation seed (FS) and Stock seed (SS) Conduct multilocation tests for the varieties that have been produced by BB Padi, Display varieties in paddy production centers 	Foundation seed (FS) and Stock seed (SS) from new superior varieties location-specific
3) 3) Seed Plant and	Supervise and certify food crop and	Certification of food

Institutional	Function	Product
Horticulture Seed Supervision and Certification Center (BPSBTTPH)	horticulture seeds	crops and horticulture seeds
4) Cihea Rice Seed Center	Producing source seeds FS class and SS classes	Source seeds FS class and SS classes from public varieties publik
5) Regency Seed Center	Producing source seeds SS class and producing ES classes seeds	source seeds SS class and ES classes seeds
6) Breeding Entrepreneurs	Producing ES classes seeds	ES classes seeds
7) Combined Seed Traders (GPPB)	To organize IPPB	-
8) Seed Trader Breeder Bonds (IPPB)	Organizing Breeders in the Regency / City area	-
9) Breeder Farmers	Producing ES classes seeds	ES classes seeds
10) BUMN Entrepreneurs (PT SHS, PT Pertani)	Producing seeds in large scale FS, SS, and ES classes	FS, SS, and ES classes seeds
11) Large Private Companies	Producing seeds in large scale FS, SS, and ES classes	FS, SS, and ES classes seeds

Source: [7]

The breeder consists of: 1) Individuals, 2) Business Entities, 3) Source Seed Management Units (UPBS) at Research Centers / Agricultural Institute for Assessment Technology, and 4) UPTD paddy Seed Centers belonging to the Provincial and Regency / City Governments. The most rice breeding activities carried out in Subang Regency (76.65%) with the potential of captive land of 10,950 ha per year and potential production potential of seeds of 42,680 tons per year.

Table 5. Number of breeders and breeding capacity and paddy seed production in West Java, 2016

No.	Regency / City	Total Breeder	Business Land (ha)	Breeding and Production Capacity		Breeding and Production Capability		Production Prospective Seed	
				Ha/Year	Ton/Year	Ha/Year	Ton/Year	Ton/Year	(%)
1	Majalengka	7	339	746	2,459	678	2,235	2,235	4.01
2	Sumedang	4	25	55	110	50	100	100	0.18
3	Cirebon	14	48	106	310	96	282	282	0.51
4	Kuningan	1	20	44	220	40	200	200	0.36
5	Garut	4	30	66	330	60	300	300	0.54
6	Tasikmalaya	3	25	55	198	50	180	180	0.32
7	Ciamis	5	26	57	974	52	885	885	1.59
8	Cianjur	18	48	106	484	96	440	440	0.79
9	Sukabumi	7	23	51	165	46	150	150	0.27
10	Bandung	4	24	53	220	48	200	200	0.36
11	Bogor	4	15	33	154	30	140	140	0.25

12	Karawang	12	580	1,276	7,464	1,160	6,785	6,785	12.19
13	Purwakarta	1	5	11	44	10	40	40	0.07
14	Bekasi	5	85	187	468	170	425	425	0.76
15	Subang	21	5,475	12,045	46,928	10,950	42,480	42,680	76.65
16	Indramayu	5	42	92	594	84	540	540	0.97
17	Kota Bandung	1	100	120	110	100	100	100	0.18
18	Kota Banjar	3	75	165	605	150	550	550	0.99
Jumlah		119	6,985	15,267	61,835	13,870	56,032	56,232	100.00

Source: [5] (processed)

Most breeding activities by breeders (Class A) are held on land owned and partnered with farmers. The pattern of partner partnership is mostly done because rice seed production activities are carried out based on orders from distributors whose demand is quite large and therefore require a wider breeding area.

Table 6. Characteristics of Class A Breeder Business in West Java

Business Characteristics	(%)	Business Characteristics	(%)
A. Scale Land Owned by Breeders		B. Produced Seed Class	
▪ 10 - < 20 ha	33.33	▪ FS	16.67
▪ >20 - < 60 ha	16.67	▪ FS+SS	50.00
▪ >60 - < 100 ha	16.67	▪ FS+SS+ES	33.33
▪ >100 ha	33.33		
C. Status of Breeding Land		D. D. Marketing of Paddy Seeds	
▪ Owned + Partner	83.33	▪ In the Regency / City	8.22
▪ Owned + manage other land	16.67	▪ In the Province	46.55
		▪ Outside the Province	45.23
E. Reasons for Producing Paddy Seeds		F. Konsumen Benih Padi	
▪ Commission	16.67	▪ Distributor + Farmer shop + Farmer Group + online	16.67
▪ Commission + Market Demand + Low risk	16.67	▪ Distributor	16.67
▪ Commission + Market Demand + Habits	16.67	▪ Local government	16.67
▪ Market Demand + Habits	16.67	▪ Distributor + Farmer shop	33.33
▪ Market Demand	33.33	▪ Distributor + Breeders	16.67

Source: Primary Data, 2018

Rice seeds produced include a combination of FS, SS, and ES seed classes that are marketed within the Regency / City, within the Province, and Outside the Province. 45.23 percent of the seeds produced in West Java are marketed outside the province and very little (8.22%) is marketed to the regency / city where the seeds are produced. The marketing pattern that is applied by breeders is by a combination of consumers, as follows: 1) Distributor-Farmer shop-online Group, 2) Distributor, 3) Local Government, 4) Farmers-Stallors, and Distributor-Breeders. However, most rice seeds are marketed to Distributors within and outside the province.

3.5. The Requirement for Paddy Seeds

Calculated from paddy fields and non-paddy fields that can be planted with paddy and the average volume of paddy seed use as much as 25 kg per hectare then to produce paddy consumption, paddy seeds are needed as much as 23,302.20 tons per year (Table 7).

Table 7. Analysis of The Requirement for Paddy Seeds

Description	2012	2013	2014	2015	2016	Average
Agricultural land						
a. Irrigated Rice Fields (ha)	756,757	748,604	749,033	749,033	736,635	748,012
b. Non-Rice Fields (Rainfed, Lebak, Tidal, Polder and others) (ha)	181,301	187,925	187,496	187,496	176,159	184,075
Total (ha)	938,058	936,529	936,529	936,529	912,794	932,088
Requirement for Paddy Seeds						
a. Irrigated Rice Fields (ton)	18,918.9 3	18,715.1 0	18,725.8 3	18,725.8 3	18,415.8 8	18,700.31
b. Non-Rice Fields (Rainfed, Lebak, Tidal, Polder and others) (ton)	4,532.53	4,698.13	4,687.40	4,687.40	4,403.98	4,601.89
Total (ton)	23,451.4 6	23,413.2 3	23,413.2 3	23,413.2 3	22,819.8 6	23,302.20

Source: [1] (processed)

Based on cropping patterns applied to paddy fields in West Java, namely: 1) paddy fields that can be planted 3 times per year, 2) paddy fields that can be planted 2 times per year, and 3) paddy fields that can be planted 1 (one) times per year (Table 8), the average paddy seed requirement is as much as 23,302.20 tons per year with detailed requirements for seeds for the Regency as much as 22,902.71 tons and seed requirements for the City as much as 399.49 tons. For a cropping pattern of 3 (three) times the paddy seed needed is 4,553.52 tons, the cropping pattern of 2 (two) times the paddy seed needed as much as 15,680.65 tons of rice per year, and 1 (one) times the paddy seed needed as much as 3,068.03 tons of rice per year.

Table 8. Requirement for Paddy Seeds in Regency / City Areas in West Java

Area	Cropping pattern applied *)			Requirement for Paddy Seeds in Rice Field			Total (ton)
	3 times per year (ha)	2 times per year (ha)	2 times per year (ha)	3 times per year (ton)	2 times per year (ton)	1 times per year (ton)	
Regency	177,812.68	617,399.20	120,896.63	4,445.32	15,434.98	3,022.42	22,902.71
City	4,328.21	9,826.72	1,824.55	108.21	245.67	45.61	399.49

Total	182,140.89	627,225.92	122,721.18	4,553.52	15,680.65	3,068.03	23,302.20
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*) Source: [1] (processed)

3.6. Surplus / Deficit of Availability of Paddy Seeds

When it is assumed that the seeds that are mostly used by farmers are SS and ES class paddy s and West Java farmers only receive quality seeds as much as 35 percent, then the calculation Paddy Seed Surplus / Deficit is known that each year the production of paddy seeds is deficit (T 9) With the deficit in the availability of rice seeds, most farmers still use their own seeds.

Table 9. The Calculation of Paddy Seed Surplus / Deficit

Uraian	2012	2013	2014	2015	2016
A. Production					
▪ SS (ton per year) (Table 3)	8,313.97	12,046.06	15,140.19	17,894.47	27,170.50
▪ ES (ton per year) (Table 3)	48,219.77	20,534.44	7,841.33	11,876.31	21,782.10
Total (ton per year)	56,533.74	32,580.50	22,981.52	29,770.79	48,952.59
B. Seeds Obtained by Farmers (35%) (ton per year)	19,786.81	11,403.17	8,043.53	10,419.77	17,133.41
C. Requirement for Paddy Seeds (ton per year) (Table 8)	23,451.46	23,413.23	23,413.23	23,413.23	22,819.86
D. Surplus/Deficit (ton per year) (B – C)	(3,664.65)	(12,010.06)	(15,369.70)	(12,993.46)	(5,686.45)

4. Conclusions

Potential rice fields in West Java an average of 748,012.40 hectares or 80.25 percent of the are agricultural land. Planting patterns are applied in paddy fields, namely: 1) paddy fields that ca planted 3 (three) times per year, 2) rice fields that can be planted 2 (two) times per year, and 3) p. fields that can be planted 1 (one) time per year. Rice production in West Java averages 11,617 tons per year consisting of 11,077,922 tons per year of paddy “sawah” and 539,871 tons per ye paddy “ladang”. During 2011-2016, paddy “sawah” production experienced a negative growth paddy “ladang” production experienced an average positive growth. Results of paddy seed surpl deficit calculation If it occurs every year, paddy seed production has a deficit.

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