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Production and seed quality enhancement of kayeli local rice by fertilization

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Abstract

Local varieties of rice are valuable germplasms and need to be conserved for breeding, moreover some of them are considered as precious for local festivity. Thus best cultivation technique is needed and the seed has to be made available. The research was aimed to obtain the optimum dose of fertilizer application for seed production and to investigate the after ripening duration of local rice seed of Kayeli. The research was conducted in West Halmahera, North Maluku from October 2016 to Juli 2017. The research was arranged in completely randomized blocked design with two factors. The first factor was four levels of NPK (15:15:15) dose, i.e. 0 kg ha^{-1}, 125 kg ha^{-1}, 250 kg ha^{-1}, and 375 kg ha^{-1}. The second factor was three levels of biofertilizer (bokashi) of 0 ton ha^{-1}, 10 ton ha^{-1}, 20 ton ha^{-1} and 30 ton ha^{-1}. The result showed that combination of NPK and bokashi increased the plant height and total number of tillers,but the higher doses decreased the yield components.The combination of NPK at 125 kg ha^{-1} and Bokashi at 10 ton ha^{-1}gave the highest seed production.The after ripening of Kayeli seeds last until 6-8 weeks after harvest.

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Introduction

West Halmahera is a one of regency in North Maluku province which has agricultural land potential i.e. 106.663 ha. The local upland rice varieties planted in West Halmahera among others, Kayeli, Jongodi, Kayoan, Kapuraca, Subana, and Goro-goro. Central Bureau of Statistics West Halmahera (2014) reported the harvest area of local upland rice of 691 ha and the production of 829 ton. Local upland rice has productivity average of 1.2 ton ha^{-1}. The low production of local upland rice is caused by the farmer cultivate technique has not been followed the cultivate technology, fertilization, and use of seed quality. Currently, Kayeli rice has started difficult to be found, among others local varieties. Kayeli rice has characteristic spesific favour, and this varieties has been difficult to be found because the farmer didn't always planted and stored this seed. In order to conserve this varieties, so required seed quality production continiously, and seed quality production can be conducted by fertilization.

Seed production was followed by genetic and agronomy principles. The agronomy principles play a role to produce the high seed physiology quality, like the nutrition to growth and development. The N nutrition deficiency according to Mawardiana *et al.* (2013) will lead the suboptimal plant growth and decreases the productivity. Phosfor has a role to increase the root development and as energy source by ATP forming (Shaheen *et al.* 2007). K has role to increased the rice productivity and resistance to fall down (Pasaribu *et al.* 2013). The excessive chemical fertilizer application could impaired soil physical, chemical, and biology properties. Organic fertilizer apllication was aimed to increased the soil physical, chimestry and biology properties, and increased soil organism. The organic fertilizer can be green manure or compost, and bokashi was a compost. Bokashi fertilizer composition is straw, organic trash, compost, husk, grass, and organic waste has been fermented using EM4 (Kusuma 2012). Organic and anorganic fertilizer combination was applied on rice would increase the production, continiuosly, and increased grain quality which would be utilized for seed.

Naturally, rice seed has dormancy which was known by *after ripening* which is seed condition cann't germinate however was planted in optimum environmental condition (Ilyas and Diarni 2007). That seed able to germinate after storage for certain time periode till be over after ripening period. After ripening depth is different for each varieties, two weeks for Sentani, four weeks for Arias, five weeks for Way Rarem, six weeks for Tondano, Singkarak, and Danau Tempe, seven weeks for Klemas and Batur, and eight weeks for Dodokan (Santika 2006). The longer after ripening period will lead the longer storage periode. In seed certification process, after ripening period should be known to determine the sampling time for seed testing in the laboratory. This research aims to obtain the best fertilization dose to growth, seed production, seed quality, and obtain after ripening period information of Kayeli rice seed.

Materials and methods

Research Time, Places, and Design

The research was carried out on October 2016 to July 2017 in West Halmahera for field experiment, and in seed quality analyze laboratory at Agronomy and Horticulture Department, Agriculture Faculty, Bogor Agricultural University for seed quality testing and after ripening period experiment. The research was arranged in Completely Randomized Block Design (CRBD) consisted of two factor i.e. NPK dose as the first factor and Bokashi dose as the second factor. The first factor consist of 0 kg NPK ha^{-1}, 125 kg NPK ha^{-1}, 250 kg NPK ha^{-1}, dan 375 kg NPK ha^{-1}. The second factor consist of 0 ton Bokashi ha^{-1}, 10 ton Bokashi ha^{-1}, 20 ton Bokashi ha^{-1} dan 30 ton Bokashi ha^{-1}. The each treatment was replaced by 3 replication.

Plant growth and seed production

Seedling was planted in experiment plot (5 m x 3 m) and spacing of 20 cm x 20 cm. The seed used was collected from Goal farmer. Planting was conducted by planting 5 seed for each planting hole. Bokahsi fertilization was applicated before planting, and NPK fertilization was applicated after 14 day after planting. Harvest was conducted after 185 day after planting. The production observation consisted of productive tiller number, grain number per panicle, pithy grain per panicle, grain weight per panicle, grain weight per plot, and production per hectare.

Seed quality

Dormancy breaking was conducted by soaked using KNO_3 2% for 24 hours. 100 seed for each replication was germinated in stencil paper using UKDdp method. The observation consisted of germination percentage, vigour index, germination speed, 1000 seed weight.

After-ripening period

After ripening periode testing was conducted for seed which has germiantion is <80%. The testing was conducted for each week till germination seed >80%. The seed was stored in rim temperature. 100 seed for each replication was germinated using UKDdp method. The observation consisted of germination percentage, vigour index, and germination speed.

Results and discussion

Plant Growth

NPK and bokashi fertilization affects to plant height. In the certain dose, the higher dose would increase the plant height of Kayeli rice. Without NPK, Increasing bokashi dose would increase the plant height (Fig. 1A). However, bokashi application when was added NPK hasn't significantly effect to increase the plant height. In the case, 250 kg NPK ha^{-1} and 10 ton bokashi ha^{-1} were the combination which results the highest plant height, i.e. 126.4 cm. Kayeli rice is classified as the high crops are compared to other upland rice, such as Cirata variety (100-110 cm), Towuti variety (95-100 cm) (BBPTP 2010).

NPK and bokashi interaction affects to total tiller number. Generally, single NPK application resulted low total tiller number (8.70 tiller). NPK and bokashi interaction could increase total tiller number. The most efficient treatment to increase total tiller number is the interaction of 125 kg NPK ha^{-1} and 10 ton bokashi ha^{-1}, that result 17.27 tiller (Fig. 1B). The highest tiller number was obtained on 125 kg NPK ha^{-1} and 20 ton bokashi ha^{-1}, 18.93 tiller. Tiller number of Kayeli rice is classified high are compared to other upland rice,such as Batutegi variety (8-12 tiller).

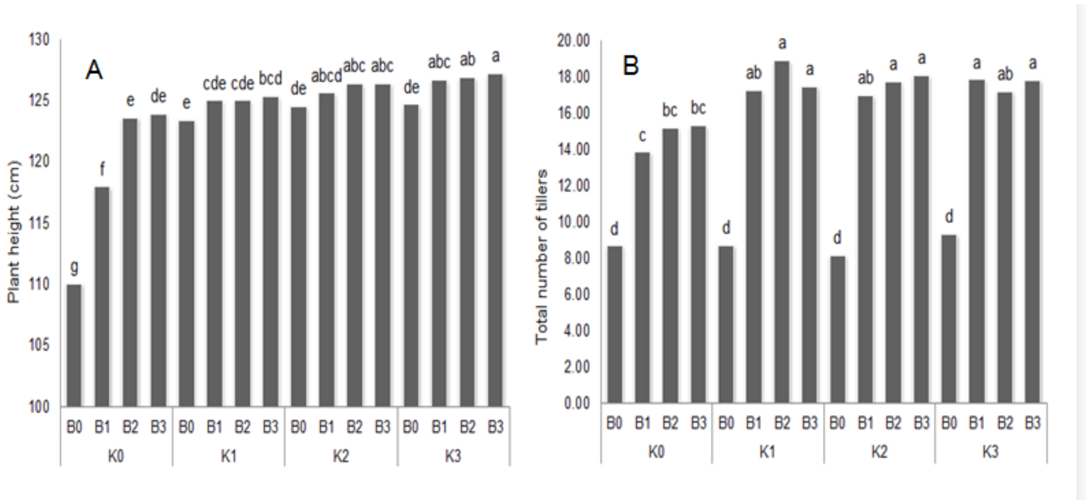


Fig. 1. The effect of NPK and bokashi interaction to plant height (A) and total tiller number (B). K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

Seed Production

One of the principle in seed production is maintance the genetic quality. In order to maintance the genetic quality is conducted by roguing for removing off types and other variety contaminant. Off types and other variety contaminant was characterized by black and hair in tip grain. Kayeli rice can be known by flag leaf corner characters, i.e. about 44 cm, and longer harvest time, about 150-180 days after planting (DAP).

The single NPK fertilization showed the low productive tiller number, except in dose 375 kg NPK ha^{-1}. Whereas, the single bokashi should be added in the high dose (30 ton ha^{-1}) to get the same productive tiller number. However, 125 kg NPK ha^{-1} and 10 ton bokashi ha^{-1} interaction was the efficient dose (Fig. 2A). This data showed Kayeli rice requires high nutrition to growth, which is suspected due long harvest time and relatively high plant. The differences grain number per panicle among treatments was relatively low. Kayeli rice without fertilization resulted > 330 grain per panicle (Fig. 2B). The highest grain per panicle i.e.368.87 grain.

Manalu *et al.* (2017) stated grain number per panicle is a one of the characters which has high heritability. That indicates this characters more controled by genetis factor. So that, the differences fertilization dose wouldn't resulted large differences, although showed significant effect. Grain number of Kayeli rice is classified high are compared to Limboto, Situ Patenggang or Inpago 6, i.e. 203-226 grain per panicle (Bakhtiar *et al.* 2014).

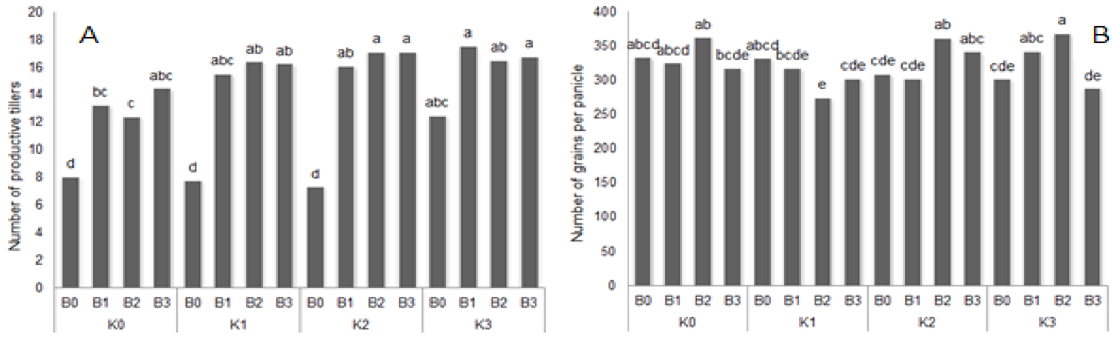


Fig. 2. NPK and bokashi interaction; A: productive tiller number, B: grain number per panicle. K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

Pithy grain number per panicle was affected by NPK and bokashi interaction. Generally, pithy grain number per panicle decreased which is followed by increased NPK and bokashi dose (Fig. 3A). The single bokashi, 20 ton ha^{-1} dose resulted the highest pithy grain number (307 grain). The lower pithy grain number (142.07 grain) was resulted by 375 kg NPK ha^{-1} and 30 ton bokashi ha^{-1} interaction. The higher NPK and bokashi dose would decreased pithy grain number, which was caused by fall plant at early flowering. Fall plant was occured cause plant is too high, the panicle is too long and heavy, and extreme weather, so grain filling isn't completely.

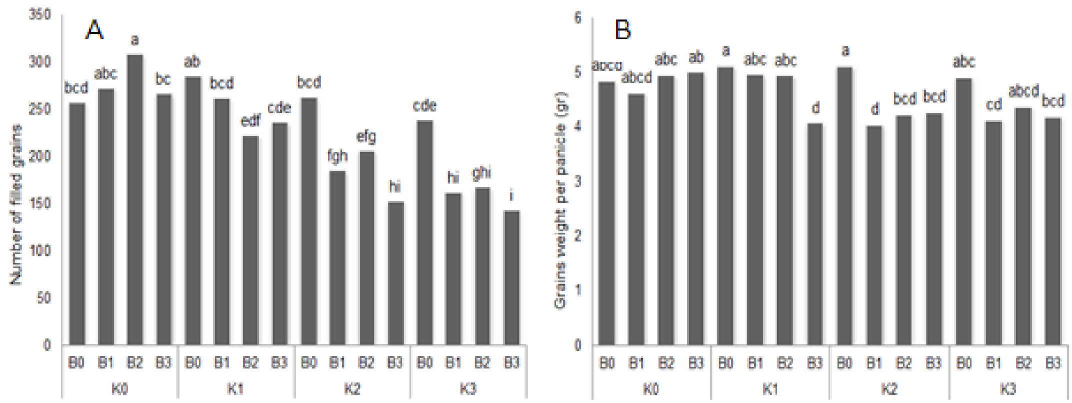


Fig. 3. NPK and bokashi interaction; A: pithy grain number, B: grain weight per panicle. K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

Grain weight per panicle showed the same trend with pithy grain number per panicle. Bokashi fertilization resulted high grain weight per panicle, about 5 g. The higher dose NPK and bokashi decreased grain weight per panicle. 250 kg NPK ha^{-1} and 375 kg NPK ha^{-1} was combined bokashi resulted grain weight per panicle, about 4 g (Fig. 3B). Grain weight per plot and production per hectare is also affected by NPK and bokashi interaction. The higher dose showedlow grain weight per plot and production per hectare (Fig. 4A, 4B).

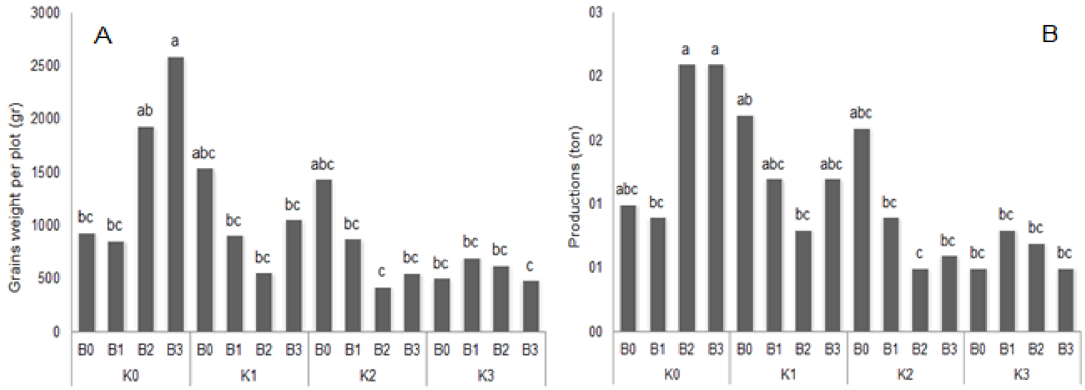


Fig. 4. NPK and bokashi interaction; A= grain weight per plot; B= production (ton ha^{-1}). K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

The most of efficient dose for seed production of Kayeli rice was 20 ton bokashi ha^{-1} which resulted grain weight per plot i.e. 2.6 kg, and production per hectare i.e. 2.1 ton per hectare. Contrary, the result reported by Nurseha *et al.* (2012) that fertilization 150 kg Urea ha^{-1}, 100 kg SP-36 ha^{-1}, 100 kg KCl ha^{-1},and bokashi to Situ Bagendit upland rice results the highest grain weight per plot (2.48 kg) was compared to sintetic fertilizer, compost+ manure, compost+husk, or compost. However, the result researchs showed bokashi application could increase upland rice production. NPK and bokashi treatment increased plant height, tiller number and productive tiller number. However, increasing plant height would increase empty grain and decreased pithy grain. Hiddink *et al.* (2005) reported that plant fall will increase empty grain, and decrease quality and qauntity production.

Seed Quality

NPK and bokashi interaction showed significant effect to 1000 seed weight, and 10 ton ha^{-1} bokashi and without NPK combination resulted the highest 1000 seed weight. The high NPK and bokashi dose would decreased 1000 seed weight (Fig. 5). These had reported by Nazirah and Damanik (2015) that increased NPK dose of 250 kg ha^{-1} wouldn't increase the growth, production and 1000 seed weight of upland rice i.e. Inpago 4, Inpago 5, and Inpago 8. That was occured because upland rice was planted in dry land, so that cause low nutrition absorption by plant, and the high dose didn't increased the growth and yield.

NPK fertilization didn't significanct effect to germination percentage (average, 24.5%) at 4 weeks after harvest (WAH), while the high bokashi dose resulted the higher germination percentage (20.3-26.7%) (Table 1). That germination percentage still very low, because seed dormancy characters. The testing seed quality by dormancy breaking treatment using KNO_3 showed increasing germination percentage, however still below 80% and this indicated that still below germination percentage minimum standar of seed quality (Crop Directorate General 2009). This showed that the Kayeli rice seed still dormance at 4 WAH and KNO_3 2% for 24 hour could be used to dormancy breaking treatment (Ilyas and Diarni 2007).

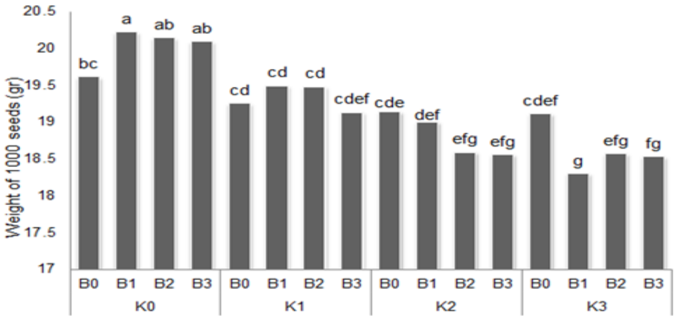


Fig. 5. 1000 seed weight of Kayeli rice seed. K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

NPK fertilization didn't significant effect to germination percentage on 4 week after harvest (WAH), i.e. average, 24.5%, while the higher bokashi dose resulted the higher germination percentage, i.e. 20.3-26.7% (Table 1). However that germination percentage still low because seed dormancy effect.

Table 1. Kayeli rice germination percentage on 4 week after harvest.

NPK treatment (kg ha^{-1})	Germination percentage (%)							
	Without dormancy breaking				Using dormancy breaking			
	Bokashi (ton ha^{-1})							
	0	10	20	30	0	10	20	30
0	18.0	19.6	24.0	22.3	58.3c	71.3abc	74.3abc	76.3abc
125	21.0	26.0	26.3	28.3	76.7abc	82.3a	76.7abc	81.0ab
250	21.0	29.0	25.0	26.3	77.3abc	79.7ab	62.7bc	77.7abc
375	21.3	26.0	27.7	29.7	61.7bc	71.0abc	73.7abc	74.3abc
Average	20.3b	25.2ab	25.8a	26.7a				

The numbers followed by same letter in same column showed did not significantly different (Duncan, α=0.05).

The germination percentage testing after dormancy breaking treatment using KNO_3 2% showedincreased the germination percentage, however still less than 80%, which showed still under seed quality germination percentage minimum standart by Directorat General of Crop Plant 2009. This data showed Kayeli rice seed still dormance until 4 WAH and that dormancy could be breaked by KNO_3 2% for 24 hours (Ilyas and Diarni 2007). Seed vigour index at 4 WAH showed still low (average, 0%) that showed the seed germinate, but still haven't to normal seedling. This indicated germination late cause the seed still dormance (Table 2). Dormancy breaking treatment resulted vigour index, 16-21.3% and wasn't affected by fertilization.

Table 2. Vigour index and germination speed on 4 WAH.

NPK Treatment (kg ha-1)	Vigour index (%)							
	Without dormancy breaking				Using dormancy breaking			
	Bokashi (ton ha^{-1})							
	0	10	20	30	0	10	20	30
0	0	0	0	0	20.0	18.3	18.7	17.7
125	0	0	0	0	17.3	16.7	15.0	20.3
250	0	0	0	0	20.7	22.0	13.3	17.0
375	0	0	0	0	27.0	18.7	17.0	11.0
Average	0	0	0	0	21.3	18.9	16.0	16.5
	Germination speed (%/etmal)							
0	1.8b	2.3b	2.9b	2.2b	12.9	13.9	13.2	16.6
125	4.2a	3.1b	2.8b	2.6b	16.9	16.8	15.9	16.0
250	2.5b	2.9b	2.2b	2.5b	15.1	17.7	14.1	14.6
375	2.4b	2.7b	2.7b	2.8b	16.8	14.3	15.5	14.4
Average					15.4	15.7	14.7	15.4

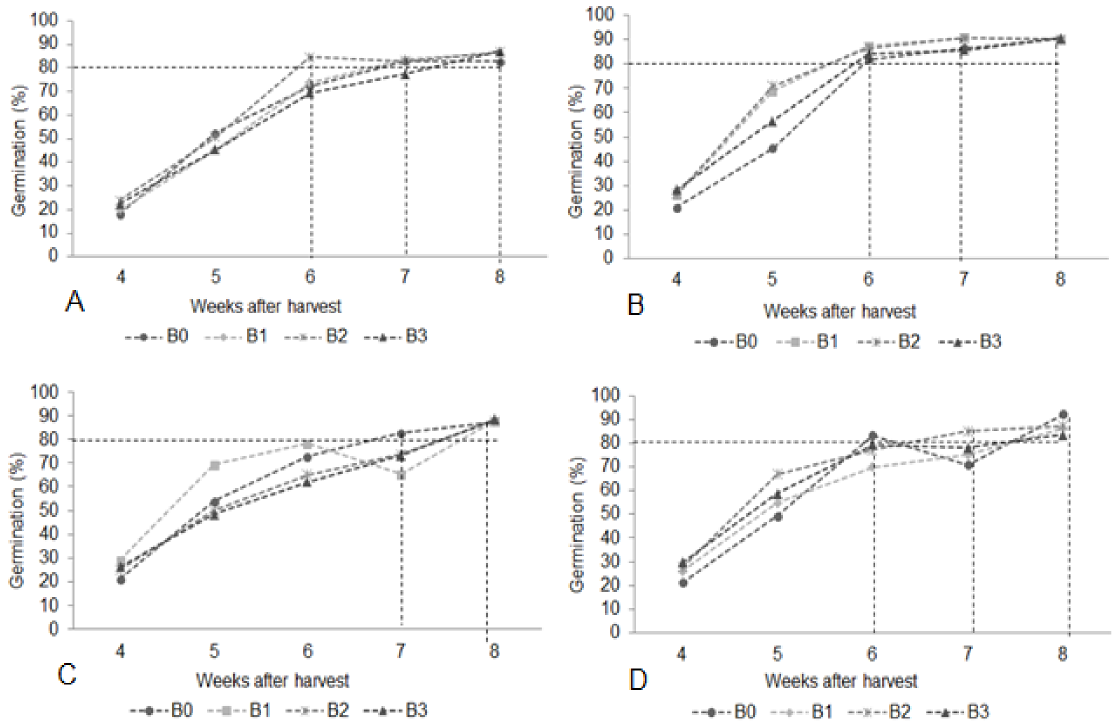
The numbers followed by same letter in same column showed did not significantly different (Duncan, α=0.05).

Seed germination speed without dormancy breaking treatment showed NPK and bokashi has significant effect. 125 kg NPK ha^{-1} without bokashi resulted the highest seed germination speed (4.2% etmal^{-1}), while other combination hasn't significant differences germination speed (1.8-3.1% etmal^{-1}). The seed was treated breaking dormancy has higher germination rate (11.0-27.0% etmal^{-1}), however wasn't significant different in among fertilization treatment (Table 2). These data showed that NPK and bokashi could increase production, however couldn't increase seed quality was resulted. In the line to Rahman *et al.* (2014), P and bokashi fertilizer interaction didn't significant effect to germination and vigour index.

After ripening period

After ripening periode is a conditions where the rice seed should be dry storage till certain time for naturally dormancy breaking (Soejadi and Nugraha 2001). Rice seed dormancy according to Wahyuni *et al.* (2004) is a natural mechanism to protect germination during seed processing, when the seed is harvested in rainfall season. The end dormancy periode was signed by 80% germination percentage (*Keputusan Menteri Pertanian* 2015).

Naturally, rice seed after ripening periode will complete for 4-6 weeks after harvest (WAH) (Wahyuni *et al.* 2006). Kayeli rice seed given various bokashi fertilizer dose without NPK has compeleted after ripening period on 6 WAH (Fig. 6A), because result more 80% germination percentage. However, germination percentage is still increasing till 8 WAH. Seed produced by fertilization of 125 kg ha^{-1} NPK and various bokashi dose showed relatively the longer after ripening periode, i.e. till germination (80%) at more than 7 WAH (Fig. 6B). Fertilization of 250 kg ha^{-1} NPK and various bokashi dose showed the longer after ripening, 8 WAH (Fig. 6C), while the seed produced by 375 kg NPK ha^{-1} and bokashi treatment has the same periode after ripening, till 8 WAH (Fig. 6D).



Gambar 6. Length of after-ripening obtained from several doses of bokashi with combination of NPK fertilizer at doseA= NPK 0 kg ha^{-1}; B= NPK 125 kg ha^{-1}; C= NPK 250 kg ha^{-1} D= NPK 375 kg ha^{-1}. K= NPK; B=bokashi; K0 = without NPK; B0=without bokashi; K1= 125 kg NPK ha^{-1}; K2= 250 kg NPK ha^{-1}; K3= 375 kg NPKha^{-1}; B1= 10 ton bokashi ha^{-1}; B2= 20 ton bokashi ha^{-1}; B3= 30 ton bokashi ha^{-1}.

Generally, the higher NPK dose would increase *after ripening* period Kayeli rice seed. The role of NPK application to extended growth and development stage of plant has been more researched (Putra 2012; Mezuan *et al.* 2002; Jufri and Rosjidi 2012), however its effect to extend the after ripening periode has been not widely studied.

Sampling in laboratory testing for seed certification according to *Keputusan Menteri Pertanian Nomor 1316/HK.150/C/12/2016* was held based on producer propose. Generally, sampling was submitted by producer on 4 WAH. This condition asumse that dormancy period till 4 WAH. Seed testing using seed dormant cann't accepted and requires to retry testing using pratreatment.The seed sertifikat/label valid for 6 months after testing. Sampling can be delayed for seed produced by high NPK dose till after ripening released.

Conclusions

1. NPK 125 kg $ha^{-1}$and bokashi 20 ton ha^{-1} fertilization treatment increased plant height. Fertilization NPK 125 kg ha^{-1} and bokashi 10 ton ha^{-1}increased tiller number and productive tiller number. The higher dose NPK and bokashi combination would decreased yield components.
2. Kayeli rice seed has *after ripening* periode till 6-8 weeks after harvest, and could be breaked by KNO_3 2% for 24 hours with a dose of NPK 125 kh ha^{-1} and bokashi 10 ton ha^{-1} is effective in breaked the dormancy of rice seed.

References

[BBPTP]. Balai Besar Penelitian Tanaman Padi. 2010. Deskripsi varietas padi. Badan penelitian dan pengembangan pertanian. Departemen Pertanian.

[BPS]. Badan Pusat Statistik West Halmahera. 2014. West Halmahera Distric in fig.s. West Halmahera (ID). BPS West Halmahera.

[Dirjen TP] Direktorat Jenderal Tanaman Pangan. 2009. Persyaratan dan Tatacara Sertifikasi Benih Bina Tanaman Pangan. Jakarta. Jakarta. Indonesia.

[KEPMENTAN]. Keputusan menteri pertanian Indonesia No.335/HK.130/C/05. 2015. Pedoman teknis sertifikasi benih tanaman pangan. Departemen Pertanian. Jakarta 14.

Abidin Z. 1987. Dasar-dasar pengetahuan tentang zat pengatur tumbuh. Angkasa. Bandung. Indonesia

Bakhtiar, Hasanuddin T, Hidayat. 2014. The identification some upland rice superior varieties in Aceh Besar. Journal Agrista **17(2),** 49-54.

Hiddink GA, Termorshuizen AJ, Raaijmakers JM, va Brugge AHC. 2005. Effect of mixed and single crops on disease suppressiveness of soils. Phytopathology **95,** 1325-1332.

Ilyas S, dan WT Diarni. 2007. Persistence and breaking seed dormancy of land rice cultivars. Jurnal Agrista **11(2),** 92-101.

Jufri A, Rosjadi M. 2012. Pengaruh Zeolit dalam pupuk terhadap pertumbuhan dan produksi padi sawah di Kabupaten Badung Provinsi Bali. Jurnal. Sains dan Teknologi Indonesia **14(3),** 161-166.

Kharismayani I. 2010. Study*after-ripening* atseveral varieties of upland rice.Bsc Thesis. Bogor (ID). Bogor Agriculture University. Bogor.

Kusuma ME. 2012. The influence of some types of manure on the quality of bokashi. Journal Tropikal animal science **1(2),** 41-46.

Manalu VMP, Wirnas D, Sudarsono. 2017. Selection characters in Early Generation for Adaptation of Rice to High-Temperature Stress**.** Journal Agron. Indonesian **45(2),** 109-116.

Mawardiana, Sufardi, Husen E. 2013. Effect of biochar residues and NPK fertilization on soil chemical properties and growth and yield of rice crops of the third planting season. Journal Conservation of land resources **1(1),** 16-23.

Mezuan IP, Handayani, Endang Inoriah. 2002. Aplication of different biofertilizer formulation in upland rice. Journal Indonesian agricultural sciences **4(1),** 27-34.

Nazirah L, Damanik BSJ. 2015. Growth and yield of three varieties of upland rice on fertilizer. Journal Floretek **(10),** 54-60.

Nurseha, Sagala D, Rajab H. 2012. Response of Highland Rice Situ Bagendit Variety to the Various Method of Manure Managemen. Journal Agroqua **10(2),** 34-38.

Pasaribu A, Kardhinata EH, Bangun MK. 2013. Test of several varieties of irrigated wetland rice (Oryza sativa L.) and potassium fertilizer application (KCL) to increase production and collapse resistance. Journal Online Agrotechnology **1(2),** 45-57.

Putra S. 2012. Effect of NPK single, compound and leaf fertilizer to increase upland rice yield of Situ Patenggang. Journal Agrotrop **2(1),** 55-61.

Rahman FH, Sumadi dan Nuraini A. 2014. Effect of P and bokashi fertilizer application on growth, yield components and seed quality of soybean (*Glycine max* L. (merr)) Journal Agri. Sci. **1(4),** 254-261.

Santika A. 2006. Testing techniques of dormancy period of rice seed (Oryza sativa L.) . Bogor. Bulletin of Agricultural Engineering **11(2),** 67-71.

Shaheen AM, Mouty MMA, Ali AH, Rizk FA. 2007. Natural and chemical phosphorus fertilizers as affected onion plant growth, bulbs yield and its some physical and chemical properties. Austral. Journal Basic Appl. Sci. **(1),** 519-524.

Soejadi, Nugraha US. 2001. Efficacy study of seed dormancy breaking. JournalAgricultural Research of Food Crops **(20),** 72-80.

Syamsudin TS, Aktaviyani S. 2012. Application of fertilization on organic rice farming using system of rice intensification (SRI) method in Sukakarsa village. Journal Agroland 16 (1).

Wahyuni S, Kadir TS, Nugraha US. 2006. The yield and quality of the upland rice seeds in the environment grew differently. JournalAgricultural research of food crops **25(1),** 30-37.

Wahyuni S, Nugraha US, Soejadi. 2004. Dormancy characterization and effective methods for breaking dormancy seeds of rice germplasm. Research agency for rice crops. Subang. Indonesian. pp **23,** 02.