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Biochar of Reed (*Phragmites autralis*) on Representative Locations in Mekong Delta of Vietnam

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ABSTRACT

A new renewable material by use reed biochar (*Phragmites autralis*); a species strong grows and very high biomass, it can be exploit a renewable resources for agriculture and environmental treatment. People often used rice husks as materials for organic fertilizers in agriculture. This study is a new discovere to made of reed biochar to filter N, P, K of chemical mineral fertilizer and pig urine use to provide bio-organic fertilizer for rice plant (ST 25). Methods: (1) Made of biochar by use the local method; (2) analyse the chemical indicators of locations on trunks, leaves, flowers; (3) identify chemical indicators of peatland on locations of experiment; (4) adsorpting chemical fertilizer (nitrogen, phosphorus and potash), pig urine filter by reed biochar, analize its chemical indicators; (5) use fomulas of reed plant biochar mixed peat and mineral inorganic fertilizer. Results: Made of reed biochar and it can adsorpted as ammonium, nitrate, nitrogen, phosphorus and kalium the pig urine and it also adsorpted inorganic fertilizer as nitrogen, phosphorus and Kalium. Thus it used for environmental treatment in the region polluted and planting local rice ST 25 in the experiment area. Conclusion: Biochar of reed can use to environment treatment and agriculture fertilizer; chemical indicators of bichar indentified; the mixed biochar, peat and inorganic in formulas in 5 days and 10 days were not differences; biochar can adsorb some chemical components of pig urine and nitrogen, phosphorus and kalium; biochar can mixed peat and inorganic mineral to planting rice ST 25 in Mekong Delta.

Keywords: Biomass of Reed; Reed Plant Biochar; *Phragmites australis*; Rice ST 25

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1. Introduction

Reed (*Phragmites australia* Cav.) is a species grows and distribution on coastal and mountain areas [1]. Its growth and high biological productivity [2], it appears in populations to dozens hundreds of hectares [3], heights 3 – 6 meter, density very high 50 -100 plants per square meter, it can use renewable source.

Study biochar [4] producing rice straw to made biochar help better soil fertility, crop product to reduce greenhouse emissions. Studies biochar to replace inorganic fertilizer [5], useful for agiculture. Studies [6] Vietnam Soil and Agriculture Institute conclude in orgarnic fertilizers producted quality is organic content >30%, humic acid >5%, total NPK>5% mixed include biochar, nitrogen, phosphorus, potash fertilizer and trace elements (TE). Relationship soil chemical composition and biological density [7], studies chemical indicators of peat on reed distribution. Research of amonium and nitrat adsorption [8] *Phragmites autralis* biochar on solution in Persian give us look at biochar of reeds. Combine inorganic mineral fertilizer to nitrogen, phosphorus, kalium fomulas after 5 days and 10 days to analized the chemical of them, adsorption of nitrogen, phosphorus and potash to use fertilizer. Mixture of fertilizer from biochar, peat and inorganic to plant rice ST 25 by trials, this result useful to agriculture development for future in Vietnam.

2. Methods

2.1. Material

The steps: As reed plants are old plants dry leaves and flowers, plants gathered and made the dry trunks, leaves and flowers.; then burn them until all the smoke is gone and cut off the oxygen; after that collect biochar to experiment. Use pig urine to filter by biochar. Mixed inorganic fertilizer (nitrogen, phosphorus and kalium) dissolve in water to filter through biochar. Make seedling of rice ST25 of Vietnam (*Oryza sativa*), planting and fertilize by fomulas to twice at 30 days and 75 days; measure growth indicators at 60 days and 125 days. The indicators include at 60 days measure stem length (Lst), Number of leaves (Lno.), leaf length (Lle.), leaf width (Lwi.), number of flowers (Fno.), number of flower bud (Bno.), leaf color (Lco.); at 125 days measure (Hcm) height of plant; (Brbu.) branches of bush; (Brpl.) branches of plant; (Sebr.) seeds of branch; (Sebu.) seeds of bush; (Stle.) length of stem; (Flsebr.) flat seeds of branch; (Seco.) color of seeds; (Lco.) color of leaves.

2.2. Methods of Investigate

2.2.1. Dry Plant Investigation

Measure of dry plant biomass by weigh total dry plant (Wdt), weigh dry plant trunk (Wdtr), weigh dry plant leaves (Wdfl), weigh dry plant flowers (Wff), unit is gram (g). Measure of plant biochar by weigh total plant biochar (Wbt), weigh plant trunk biochar (Wbtr), weigh leave biochar (Wbl), weigh plant flower biochar (Wff), unit is gram (g).

2.2.2. Peat Investigation

Based on the high distribution map of peat soil, 15 peat investigation plots were established [9]. Use the hand drill to take samples, total of 15 plots set up to survey the growth and biomass of the reed on three locations of MD. There are 5 plots for a locations. Each location to take samples is three [10], and each sample is one kilograms and write coded a mumber of the site at location as UTM1, UTm^2, UTM3, UMT4 [11], following the same name of the survey plots, then gets them to the laboratory of Southern Institute of Forestry Science for analysis.

The characteristics of the peat soil are evaluated through the indicators: pH (H_2O); Humus (%), Total nitrogen (%), P_2O_5 (%), K_2O (%), Fe^{2+} (mg/100 g), SO_4^+ (mg/100 g), humic acid (%). The analysis method of pH (H_2O) were determined with a pH meter. Humus content and humic acid evaluated by Walkley Black [11], total nitrogen by the Kjeldhahl method [11] P_2O_5 was indicated by the colorimetric method. All indications were analyzed at the laboratory of the Southern Forest Sciences Institute and the Laboratory of Kien Giang University.

2.2.3. Method of Making Reed Biochar

The reed parts harvested from the forest are brought to the yard, dried until the weight is constant. The design of the biochar furnace is a metal tank with 2 layers, the inner layer and the bottom of the furnace have many holes evenly spaced so that oxygen can pass through easily, creating conditions for fast and complete combustion. The outer layer is a metal

tank that is sealed when covered, causing loss of oxygen. Cut the dry reeds into short pieces and put them in the inner layer tank. Burn the reeds at the bottom of the tank first until there is no more smoke coming out. Cover the outer tank suddenly with a lid on top to completely cut off oxygen. Wait for the biochar to cool down to the same temperature as the outside, then collect the product (**Figure 1**).

2.2.4. Reed Biochar Chemical Indicators (Biochar Is Selected to Vietnamese Standards)

Make of biochar from (**Figure 1**) the indicators of biochar analyzed include: pH, Humic acid %, C%, OM%, N% total, P% total, K% total, Ca%, Mg%, SiO_2%.

Figure 1. Reed plant made of Reed biochar.

2.2.5. Method of Filtering Pig Urine through Biochar

Using a tupe D = 10 cm, height H = 20 cm, with a capacity greater than 1000 milliliters (ml), the weight of reed biochar is ground into fine powder and sieved through a 1 mm sieve, the weight of biochar is filtered according to 4 levels: Fomula 1 (Fo1) = 30 g, Fo.2 = 50 g, Fo3 = 70 g, Fo4 = 90 g (Each Fo level is repeated 3 times); the amount of urine filtered for each Fo is 1000 ml, the filtration time is from the time the solution is added until it is completely filtered.

Pi0: Pig urine without filtring reed biochar

Pi1: Pig urine when filtered 1000 mililiters with 30 grams biochar

Pi2: Pig urine when filtered 1000 mililiters with 50 grams biochar

Pi3: Pig urine when filtered 1000 mililiters with 70 grams biochar

Pi4: Pig urine when filtered 1000 mililiters with 90 grams biochar

2.2.6. Method of Filtering Inorganic Substances N, P, K

Use a tube D = 10 cm, height H = 20 cm, with a capacity greater than 1000 ml, biochar with fine particles 1 mm, biochar filtered to 4 levels Fo1 = 30 g, Fo2 = 50 g, Fo3 = 70 g, Fo4 = 90 g (Each Fo level is repeated 3 times), use 1g N (nitrogen) 46%, 1g P 61% and 1g K 61% mixed with 1000 ml, weight of water mixed with 1 g minerals with 1000 ml, after dissolving the formulas, filter through biochar in turn, the filtering time is from the beginning until it is completely filtered.

2.2.7. Mixed Fertilizer in 5 Days and 10 Days and Experiment Application for Rice ST 25

Fo.1a: Fomular 1 (Control 5 days). Fo.1b: Fomula (Control 10 days).

Fo.2a: Fomular 2 (5 days). Fo.2b: Fomula 2 (10 days)

Fo.3a: Fomular 3 (5 days). Fo.3b: Fomula 3 (10 days).

Fo.4a: Fomular 4 (5 days). Fo.4b: Fomula 4 (10 days)

Fo.5a: Formular 5 (5 days). Fo.5b: Fomula 5 (10 days).

Fo.6a: Fomular 6 (5 days). Fo.6b: Fomula 6 (10 days)

Fo.7a: Fomular 7 (5 days). Fo.7b: Fomula 7 (10 days).

Fo.8a: Fomular 8 (5 days). Fo.8b: Fomula 8 (10 days)

With 8 experimental fomulas labeled

Fo.1: 100g Biochar (Control)

Fo.2: 4g Nitrogen 46% + 3g phosphorus 61% + 3g

Potash 61% (10g NPK+ 90 g Biochar = 100g fertilizer)

Fo.3: 10g (Nitrogen 16% + Phosphorus 16% + 8%) + 90g Biochar = 100g fertilizer

Fo.4: 10g (Nitrogen 20% + Phosphorus 20% + Potash 15%) + 90g Biochar = 100g fertilizer

Fo.5: 50g Biochar + 40g Peatland + 10g (Nitrogen 20% + Phosphorus 20% + Potash 15%)

Fo.6: 60g Biochar + 30g Peatland + 10g (Nitrogen 20% + Phosphorus 20% + Potash 15%)

Fo.7: 70g Biochar + 20g Peatland + 10g (Nitrogen 20% + Phosphorus 20% + Potash 15%)

Fo.8: 80g Biochar + 20g Peatland + 10g (Nitrogen 20% + Phosphorus 20% + Potash 15%)

The dates after mixed during 5 days and 10 days: Analized indicators are humic acid (%), organic matter OM(%), C (%), N(%), P(%), K(%), Ca(%), Mg(%), SiO_2(%).

2.2.8. Indicators Measured on Rice after 30 Days and 125 Days

On 30 days: Indicators measured include (NoBr.) number of branch; (NosubBr.) number of sub branch; (Lle.) leaves length; (Stle.) stem length; (Stco.) color of stem; (Lco.) color of leaves. On 125 days: Indicators meassured include (Hcm) height of plant; (Brbu.) branches of bush; (Brpl.) branches of plant; (Sebr.) seeds of branch; (Sebu.) seeds of bush; (Stle.) length of stem; (Flsebr.) flat seeds of branch; (Seco.) color of seeds; (Lco.) color of leaves.

2.3. Data Analysis

The analysis use t-tests and one-way analysis of variance (ANOVA) to compare the mean of biochar and peat[12]. Correlation analysis use the Pearson correlation coefficient described the interdependence between peat quality and the development of reed plants. A correlation is considered significant when the p-value is less than 0.05, and the correlation coefficient (r) is more significant than 0.5 in absolute value[13]. The analysis focused on the relationship between the peat environment indicators and the growth of reed plant on 3 different. Spearman's correlation coefficient was used for analysis, and the significance level will be set at α=0.05[13]. If the correlation coefficient of the variable (peat) levels is significant, hypothesis How will be rejected, indicating a correlation between peat characteristics and reed plant growth.

The characteristics of the biochar on reed plants were evaluated through the indicators: pH(H_2O), humic acid (%), organic matter OM %, C %, N %, P %, K %, Ca %, Mg %, SiO_2 %. The analysis methods of pH by measuring the extration ratio 1: 2.5; K %, Ca %, Mg % mearsured with an atomic absorption machine; Silic mearsured according to method of AOAC (Asociation of analytical communities); Nitogen measured according to method Kjeldahl; Phosphorus measured by wavelength colormetric method; Ash calculated by ashing method.

Data processing, including statistical calculations, description, test hypotheses, and graph drawing, was performed use[12]. Microsoft Excel 2016, Statgraplies Centurion 19.12, and IBM SPSS Statistic version 20.0.

3. Results

3.1. Dry Plant and Biochar

The dry plant weight of reed in 3 locations showed (**Table 1**): The weight of dry plant is 65.02g per plant (62.99 – 66.58g) per plant; the weight of the dry reed plant trunk is 43.77g per plant, from 42.84 – 44.99 g per plant; the weight of the dry plant leaves is 19.45 g per plant, from 18.57 – 21.21 g per plant; the weight of the dry plant flower per plant is 2.60 g per plant, from 2.52 – 2.77 g per plant. The weight of the dry plant per square meter is 3.47 kilogram per square meter, from 2.20 – 3.54 g per square meter. The water in plant was lost in procesing made the dry plant is 3.47 kilogrm per square meter. Statistical analysis in 3 locations, the indicators that did not significantly were the dry plant, dry plant trunk, dry leaves, the dry flowers of reed plant and significantly is the dry flowers of them. With a density of 60 plants per square meters, the mount of dry material from reeds is 65 g per plant, the annual harvest is 3.9 kg per square meters, equivelent to 39,000 kg per hectare.

The weight indicators of reed biochar in three locations showed (**Table 2**): The weight reed plant biochar is 13.59 g per plant, from 10.27–17.55 g per plant; the biochar weight of the reed plant trunk is 7.62 g per plant, from 5.75 – 9.83 g per plant; the biochar weight of the reed plant leaves is 4.23 g per plant, from 3.27–5.41 g per plant; the biochar weight of the reed plant flowers is 1.77 g per plant, from 1.36–2.28 g per plant, from 1.36–2.28 g per plant. Statistical analysis in 3 locations, the indicators that did differ significantly were

the biochar of plant trunk, dry leaves and the flowers of reed plant with $\alpha = 0.05$ $\alpha < 0.00$*. With a density of 60 plants per square meters, the mount of biochar from reeds is 13,59 g per plant, the annual harvest is 0.815 kg per square meters, equivelent to 6,642 kg per hectare. With a very significant biological mass this allows the economic potential for environmental and agricultural raw materials to to be exploited economically.

Table 1. The weight indicators of dry reed plant.

Location	Wtdr	Wdrtr	Wdrl	Wdrfl	Wdr/m^2	Wwl/m^2	N/m^2
Lo.1	65.49	43.49	18.57	2.52	3.60	3.54	55
Lo.2	62.99	44.99	18.57	2.52	4.38	4.68	68
Lo.3	66.58	42.84	21.21	2.77	3.73	2.20	56
Average	65.02	43.77	19.45	2.60	3.87	3.47	60
$\alpha = 0.05$	0.29N	0.27N	0.07N	=0.02*			0.24N

Note: Wtdr weight of dry plant; Wdrtr weight of dry trunk; Wdrl weight dry leaves; Wdr/m^2 weight of dry plant per square metter, Wwl/m^2 weight of lost water in plant per square meter; (*) significant difference, (N) not significant difference.

Table 2. The weight indicators of reed biochar in three locations.

Location	Wbit (g)	Wbitr (g)	Wbil (g)	Wbifl (g)	N/m^2
Lo.1	12.95	7.27	4.00	1.68	55
Lo.2	17.55	9.83	5.41	2.28	68
Lo.3	10.27	5.75	3.27	1.36	56
Average	13.59	7.62	4.23	1.77	60
$\alpha = 0.05$	<0.01*	<0.01*	<0.01*	<0.01*	0.24N

Note: Wbit weight of plant biochar; Wbitr weight of biochar trunk; Wbil weight of leave biochar; Wbifl weight of flower plant; (*) significant difference, (N) not significant difference.

3.2. Chemical Indicators of Biochar

The chemical indicators of reed trunk (**Table 3**): pH is 10.66 (10.64–10.68); carbon C % is 17.24%, from (17.24–17.24%); humic acid 1.38, from 1.32–1.43%; organic matter OM% is 34.48%, from 34.48–34.48; nitrogen N% is 0.16%, from 0.15–0.17%; phosphorus P% is 0.41%, from 0.39–0.44%; kalium K% is 0.72%, from 0.70–0.74%; calcium Ca% is 0.14%, from 0.10–0.16%; magenium Mg% is 0.15%, from 0.14–0.17%; silicium SiO% is 4.69%, from 4.26–5.13%. Statistical analysis in 3 locations, the indicators that did not differ significantly were the C %, OM %, N %, P %, K %, Ca %. The weight of the reed trunk is 7.62 g per reed, which is highest among the reed part. Finding this indicator allows to evaluate its potential in this population biomass. The chemical indicators of reeds trunk pH is 10, this thing can improve acid sulfat soil inMekong Delta very sccessfully; OM % organic mater is 34.48% this rate is very high so use for organic fertilizer is very good; the inicators as N %, P %, K % accounting for les than 1%, so it is necessary to suplemnt inorgrnic minerals from these substances to increase fertilizer eficiency.

Table 3. Chemical indicators of biochar in reed trunk.

Locations	pH	C %	Humic Acid	OM %	N %	P %	K %	Ca %	Mg %	SiO %
Lo.1	10.64	17.24	1.43	34.48	0.17	0.39	0.70	0.16	0.15	4.67
Lo.2	10.66	17.24	1.32	34.48	0.17	0.40	0.71	0.10	0.14	4.26
Lo.3	10.68	17.24	1.38	34.48	0.15	0.44	0.74	0.15	0.17	5.13
Average	10.66	17.24	1.38	34.48	0.16	0.41	0.72	0.14	0.15	4.69
$\alpha = 0.05$	<0.00*	1.0N	<0.00*	1.00N	0.64N	0.89N	0.79N	0.11N	=0.02*	<0.00*

(*) significant difference, (N) not significant difference.

The chemical indicators of reed leaves (**Table 4**): pH is 10.24, from 10.04–10.38; carbon C % is 17.87%, from 16.03–18.96%; humic acid 1.29, from 1.27–1.31%; organic matter OM % is 35.75 %, from 32.07–37.93%; nitrogen N % is 0.20%, from 0.19–0.21%; phosphorus P % is 0.40%, from 0.39–0.42%; kalium K % is 0.72%, from 0.69–0.75%;

calcium Ca % is 0.10%, from 0.09–0.12%; magenium Mg % is 0.16 %, from 0.16–0.16%; silicium SiO % is 4.93%, from 4.72–5.24%. Statistical analysis in 3 locations, the indicators that did not differ significantly were the humic acid, P %, K %, Ca % and Mg %. The indicators that did differ significantly were pH, C %, OM % and SiO % with ($\alpha = 0.05$) is $\alpha < 0.00$*. The weight of the reed leaves is 4.23 g per reed (**Table 3**), which is high among the reed parts. Finding this indicator allows to evaluate its potential in this population biomass. The chemical indicators of reeds trunk pH is 10, this thing can improve acid sulfat soil in Mekong Delta very sccessfully; OM % organic mater is 35.75 % this rate is very high so use for organic fertilizer is very good; the inicators as N %, P %, K % accounting for les than 1%, so it is necessary to supplement inorgrnic minerals from these substances to increase fertilizer eficiency.

Table 4. Chemical indicators of biochar in reed leaves.

Locations	pH	C %	Humic Acid	OM %	N %	P %	K %	Ca %	Mg %	SiO %
Lo.1	10.38	16.03	1.31	32.07	0.21	0.39	0.75	0.12	0.16	4.72
Lo.2	10.29	18.62	1.27	37.24	0.20	0.40	0.69	0.09	0.16	4.84
Lo.3	10.04	18.96	1.29	37.93	0.19	0.42	0.72	0.10	0.16	5.24
Average	10.24	17.87	1.29	35.75	0.20	0.40	0.72	0.10	0.16	4.93
$\alpha = 0.05$	<0.00*	<0.00*	0.12N	<0.00*	0.81N	0.5N	0.09N	0.59N	1.0N	<0.00*

(*) significant difference, (N) not significant difference.

The chemical indicators in reed flowers showed (**Table 5**): pH is 9.09, from 8.88–9.40; carbon C % is 20.12%, from 18.97–20.69 %; humic acid 1.09, from 1.02–1.14 %; organic matter OM% is 40.23 %, from 37.97–41.38%; nitrogen N% is 0.17%, from 0.16–0.18%; phosphorus P % is 0.36%, from 0.33–0.39 %; kalium K % is 0.67%, from 0.67–0.68%; calcium Ca % is 0.16 %, from 0.11–0.18%; magenium Mg % is 0.15%, from 0.14–0.15%; silicium SiO % is 4.29%, from 3.97–4.65%. Statistical analysis in 3 locations, the indicators that did not differ significantly were the N %, P %, K %, Mg %. The indicators that did difer significantly were pH, C %, acid humic %, OM %, Ca % and SiO % with ($\alpha = 0.05$) is $\alpha < 0.00$*. The weight of the reed flower is 4.23 g per reed (**Table 3**), which is small among the reed parts. Finding this indicator allows to evaluate its potential in this population biomass. The chemical indicators of reeds trunk pH is 10, this thing can improve acid sulfat soil in Mekong Delta very sccessfully; OM % organic mater is 40.23% this rate is very highest so use for organic fertilizer is very good; the inicators as N %, P %, K % accounting for les than 1%, so it is necessary to supplement inorgrnic minerals from these substances to increase fertilizer eficiency.

Table 5. Chemical indicators of biochar in reed flowers.

Locations	pH	C %	Humic Acid	OM %	N %	P %	K %	Ca %	Mg %	SiO %
Lo.1	9.4	18.97	1.14	41.38	0.18	0.37	0.67	0.18	0.15	4.25
Lo.2	9.0	20.69	1.11	37.93	0.16	0.39	0.68	0.11	0.15	4.65
Lo.3	8.88	20.69	1.02	41.38	0.17	0.33	0.67	0.18	0.14	3.97
Average	9.09	20.12	1.09	40.23	0.17	0.36	0.67	0.16	0.15	4.29
$\alpha = 0.05$	<0.00*	<0.00*	<0.00*	<0.00*	0.61N	0.15N	0.88N	<0.00*	0.73N	<0.00*

(*) significant difference, (N) not significant difference.

Chemical analysis of biochar in three locations showed (**Table 6**) The chemical composition of reed biochar in the 3 area selected for investigation shows (**Table 6**): pH (9.66–10.15); carbon C % (17.41–18.96); humic acid (1.23–1.29); organic matter OM % (34.83–37.93); nitrogen N % (0.17–0.19 %); phosphorus P % (0.38–0.40%); kalium (0.69–0.71%), calcium Ca % (0.12–0.15 %); magnesium Ca % (0.2–0.15%), silicium SiO % (4.55–4.78 %). Because reed biochar has alkaline pH from 9 to 10, so it can used as a fertilizer to improve the acid sulfate soil is the best. The organic matter content in biochar is higher than 30 %, so it can be used as organic fertilizer for agriculture; other study showed biochar is nutrient values[14] The chemical composition of biochar has very low indicators such as nitrogen 0.17–0.19

%, phosphorus 0.38–0.40 %, kalium 0.69–0.71 %, these indicators in fertilizer that are esential for plant. So if we want to use reed biochar to make organic fertilizer in agriculture, it is necessary to add inorganic chemical indicators. Statistical analysis in 3 investigation locations, the chemical indicators that did not have significant diffrences between locations are pH, carbon C %, humic acid, organic matter OM %, nitrogen N %, phosphorus P %, kalium K %, and silicium SiO %. The chemical components that have meaningful differences are calcium Ca % and magnesium Mg %.. The chemical composition on reed biochar shows that pH is 9.89 which can be applied as fertilizer to improve acid sulfate soil; C % is 18.41 %, OM % is 36.82 % which are important parts in organic fertilizer; SiO % is 4.64% it can improve the physical soil; except humic acid %, N %, P %, K % are needed to be supplemented when using it as organic fertilizer; this discovery is very necessary for the meaning of clean agricultural economic development for the Mekong Delta.

Table 6. Chemical analysis of biochar in three locations.

Location	pH	C %	Humic Acid %	OM %	N %	P %	K %	Ca %	Mg %	SiO %
Lo.1	9.66	18.96	1.23	37.93	0.17	0.40	0.70	0.15	0.15	4.78
Lo.2	9.86	18.85	1.23	37.70	0.18	0.40	0.69	0.12	0.15	4.58
Lo.3	10.15	17.41	1.29	34.83	0.19	0.38	0.71	0.15	0.15	4.55
Average	9.89	18.41	1.25	36.82	0.18	0.39	0.7	0.14	0.15	4.64
$\alpha = 0.05$	0.24N	0.055N	0.53N	0.054N	0.057N	0.072N	0.045N	0.03*	0.05*	0.043N

(*) significant difference, (N) not significant difference.

3.3. Chemical Indicators of Peatland

Peat chemical indicators in 3 locations (pH, Humic acid %, N %, P %, K %, NH_4^+, SO_4^{2-}, Fe^{2+}) showed (**Table 7**): The peat chemical indicators of 3 locations includes: pH is 4.41 (4.35–4.37); humic acid is 13.06 % (6.24–17.54 %); nitrogen N% is 0.10 % (0.08–0.12 %); phosphorus is 0.10 % (0.08–0.12 %); kalium K% is 0.21 % (0.11–0.30 %); NH_4^+ is 16.70 mg/l (15.92–17.33 %); SO_4^{2-} is 0.07 mg/l (0.06–0.08 %); Fe^{2+} is 1.45 mg/l (0.82–2.13 mg/l). Statistical analysis in 3 locations, the indicators that did not differ significantly were the pH. The indicators that did difer significantly were, C %, humic acid %, N %, P %, K %, NH_4^+, SO_4^{2-} and Fe^{2+} with (α= 0.05) is α<0.00*. Peat with pH, N %, P %, K %, SO_4^{2-} very low, with Fe^{2+} is high, it can make the soil acidic due to high alum; but humic acid averages up to 13 % and NH_4^+ is 16.7 %, when used with organic fertilizers it can contribute to plant growth; when using peat with reed biochar, it will neutralize the soil, promoting the effectiveness of fertilizers from peat and biochar.

Table 7. Peat chemical indicators in 3 locations (pH, Humic acid, N %, P %, K %, NH_4^+, SO_4^{2-}, Fe^{2+}).

Location	pH	Humic Acid %	N %	P %	K %	NH_4^+ mg/L	SO_4^{2-} mg/L	Fe^{2+} mg/L
Lo.1	4.42	17.54	0.42	0.08	0.30	15.92	0.06	2.13
Lo.2	4.47	15.30	0.29	0.10	0.22	16.48	0.07	1.41
Lo.3	4.35	6.24	0.16	0.12	0.11	17.33	0.08	0.82
Average	4.41	13.06	0.10	0.10	0.21	16.70	0.07	1.45
$\alpha = 0.05$	0.22N	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*

Note: mg/L (miligram per water litter).
(*) significant difference, (N) not significant difference.

3.4. Adsorption of Pig Urine and Inorganic Fertilizer

Adsorption of biochar by pig urine is filtered through biochar[15] showed (**Table 8**): Pig urine was analysed with the following chemical composition: pH is 8.8; NH_4^+, NO^{2-} is 150 miligram per liter (mg/l); NO^{2-} is 1.5 mg/l, NO^{3-} is nothing, nitrogen (N) is 984 mg/l, phosphorus (P) is 48 mg/l; kalium (K) is 0.13 mg/l; among these, nitrogen and NO^{2-} are found to have very high concentrations, especiallly nitrogen at 0.098 gram per liter (g/l) and NH_4^+ at 0.015 (g/l) that they are the cause of environmental pollution. Pig urine was

sequentially filtered through reed biochar with weights of 30 gram (g), 50g, 70g, 90g. The results obtained pH were 9.07, 9.21, 9.41 and 9.53 (compared to control was 8.8). NH_4^+ analyzed as 140 mg/l, 135 mg/l, 134 mg/l, 130 mg/l. NO^{2-} analyzed as 1.5 mg/l, 0.6 mg/l, 0.55 mg/l, 0.5 mg/l, 0.45 mg/l. NO3+ all of nothing. Nitrogen N is 984 mg/l, 860 mg/l, 838 mg/l , 821 mg/l and 726 mg/l. Phosphorus N is 48 mg/l, 17 mg/l, 13 mg/l, 10 mg/l and 4 mg/l. Kalium K analyzed is 0.13 mg/l, 0.14 mg/l, 0.15 mg/l, 0.17 mg/l and 0.20 mg/l. Statistical indicators that have significant differrences all of indicators with ($\alpha = 0.05$) is $\alpha<0.05$*. The adsorption of pig urine with nitrate and ammonium wastewater causing environmental emissions was studied by filtering through biochar. This study helps determine the amount of NO^{2-}, NH_4^+ that can be obtained through the amount of reed biochar, contributing to the treatment of environmental pollution and increasing the amount of nitrogen for biochar fertilizer to provide plants.

Table 8. Pig urine after filtered through biochar is adsorbed.

Locations	pH	NH_4^+ (mg/L)	NO^{2-} (mg/L)	NO^{3-} (mg/L)	N (mg/L)	P (mg/L)	K (mg/L)
Pi0 (pig urine)	8.8	150	1.5	nothing	984	48	0.13
Pi1 (30g Biochar)	9.07	140	0.6	nothing	860	17	0.14
Pi2 (50g Biochar)	9.21	135	0.55	nothing	838	13	0.15
Pi3 (70g Biochar)	9.41	134	0.5	nothing	821	10	0.17
Pi4 (90g Biochar)	9.53	130	0.45	nothing	726	4	0.20
Average	9.305	134.75	0.525	nothing	811.25	11	0.165
$\alpha = 0.05$	<0.00*	<0.00*	<0.00*		<0.00*	0.00*	0.00*

(*) significant difference, (N) not significant difference.

The reed biochar adsorption with pig urine showed (**Table 9**): Prepare 1000 mililiter of pig urine filtered to reed biochar with increasing weight from 30 g, 50 g, 70 g, 90 g, the results showed as pH increased (8.87–8.97); Nitrogen increased (0.47–0.56 %); Phosphorus increased (0.32–0.39 %), Kalium increase (0.32–0.39 %); NO^{2-} increased (0.28–0.36 %), NO^{3-} increase (0.89–1.46 %), NH_4^+ increased (11.77–14.48 %); biochar can adsorpted the pollution indcators for wastewater[16] and removal amonium in the environment[17] and[18]. Statistical indicators that have significant differrences all of indicators with ($\alpha = 0.05$) is $\alpha < 0.00$*. This study has the following implications: in livestock farming, pig urine will cause environmental pollution from the emission of NH_4^+, NO^{2-}, NO^{3-}; the study will quantify the level of environmental waste adsorption in pig wastewater; furthermore, the content obtained waste from N%, P%, K% inorganic matter, NH_4^+, $NO^{2-}$and NO^{3-} will let us know that when composting biochar with wastewater, a certain amount of nutrients will be obtained in livestock farming; contribute to solving environmental pollution but also increase productivity in agriculture.

Table 9. The reed biochar adsorption with pig urine.

Biochar	pH	N %	P %	K %	NO^{2-}	NO^{3-}	NH_4^+
30 gram	8.87	0.47	0.29	0.32	0.28	0.89	11.77
50 gram	8.93	0.52	0.32	0.35	0.30	1.19	13.21
70 gram	8.95	0.54	0.34	0.36	0.33	1.33	13.89
90 gram	8.97	0.56	0.37	0.39	0.36	1.46	14.48
$\alpha = 0.05$	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*

(*) significant difference, (N) not significant difference.

Disolve 1000 milliliters and 10 gram nitrogen 46 %, then filter through biochar with amounts[15] 30, 50, 70 and 90 gram, result analyzed showed (**Table 10**): Adsorption of nitrogen on peat 30 gram (g) is 0.17 % and 90 g is 0.31 %; phosphorus on peat 30 g is 0.35 % and on 90 g 0.46 %; kalium on peat 30 g is 0.43% and 90 g 0.48%; adsorption of biochar with phosphorus showed useful with phosphorus[19] and amonium[20] remained in the environment. This result showed biochar can adsorbable nitrogen, phosphorus and kalium in the natural environment.Statistical indicators

that have significant differrences all of indicators with (α = 0.05) is α < 0.00*. Research on the adsorption of inorganic mineral fertilizers has economic significance in determining the amount of inorganic fertilizer solution needed when mixed with biochar, so that this amount is not too much when producing effective biological organic fertilizers for crops.

Table 10. The reed biochar adsorption inorganic nitrogen (N), phosphorus (P) and kalium (K).

Biochar	N %	P %	K %
30 gram	0.17	0.35	0.43
50 gram	0.22	0.41	0.45
70 gram	0.24	0.44	0.46
90 gram	0.31	0.46	0.48
$\alpha = 0.05$	<0.00*	<0.00*	<0.00*

(*) significant difference, (N) not significant difference.

3.5. Use Biochar Fomulas

Fomulas for mixing biochar with inorganic fertilizers from fomula 2 to 4 showed (**Table 11**): Fomulas 2–4 (10 g Nitrogen 46 %, 10 g phosphorus 61%, 10 g kalium 61% mixed 90 g reed biochar keeping 5 days and 10 days) after analizer chemical indicators as pH (10.04–10.46); carbon C % (17.31–17.54 %); humic acid (1.22–1.35 %); organic matter OM % (36.36–39.92 %); nitrogen N % (2.46–4.87 %); phosphorus P % (2.69–4.11 %); kalium K % (9.18–15.47 %); calcium Ca % (0.13–0.15 %); magnesium (0.13 - 0.15 %); silicium SiO% (4.25–4.52 %); These fomulas compare the control only organic matter, nitrogen, phosphorus and kalium are difference that showed in analysis of biochar chemical data. The chemical indicators: In fomula 2 Nitrogen is 4.22 % in 5 days and 4.87 % in 10 days; phosphorus is 3.55 % in 5 days and 4.11 % in 10 days; kalium is 11.81 % in 5 days and 13.59 % in 10 days; organic matter OM % is 39.03 % in 5 days and 36.98 % in 10 days. In fomula 3 nitrogen is 2.35 % in 5 days and 2.96 % 10 days; phosphorus 2.69 % in 5 days and 3.80 % in 10 days; kalium is 9.18 % in 5 days and 12.33 % in 10 days; organic matter OM % is 37.89 % in 5 days and 36.36 % in 10 days. Fomula 4 Nitrogen is 2.46 % in 5 days and 3.55 % in 10 days; phosphorus is 2.69 % in 5 days and 3.86 % in 10 days; organic matter is 37.89 % in 5 days and 36.36 % in 10 days. In the createria of the Ministry of Agriculture and Rural Development with the mandatory criteria for organic fertilizer are the organic is 30 %, the nitrogen ratio is 2%, the phosphorus ratio is 2% and the kalium ratio is 3%. Comparing these criteria, the above experiment is satisfactory and feasible for the research potential of reed biochar fertilizer. Regarding the effectiveness of mixing inorganic fertilizers are fomula 2 (10% N, 10% P, 10% K) and fomula 4 (20 % N, 20 % P, 15 % K) are effective in adsorption nitrogen, phosphorus and kalium in biochar are the highest. Statistical indicators that do not have significant differrences are pH, humic acid, calcium, magnesium and silicium. The indicators with statistically significant differences are nitrogen, phosphorus, kalium, and organic matter. This study is meaningful for us to know, after producing fertilizer from the combination of inorganic and organic fertilizers with a long storage time of up to 10 days in nature without preservation, can it evaporate and lose the content of N%, P%, K% that we mixed? so that we know when storing inorganic fertilizers in nature without preservation.

Growing rice according to experimental fomulas, fertilize after 7 days and measured results after 30 days of age showed (**Table 12**): The plant height of the control is 22.55 centimeters (cm), all of fomulas from 2 to 8 are analyzed as follows: Fo.2 is 36.44 cm; Fo.3 is 36.44 cm; Fo.4 is 35.96 cm; Fo.5 is 36.63 cm; Fo.6 is 35.98 cm; Fo.7 is 36.56 cm; Fo.8 is 36.56 cm. Number branch of plant (No. Br.) Fo.1 control is 3 and all of fomulas (3.04–4.03 cm). Number of sub branch Fo.1 control is 1 and all of fomulas (1.04–2 cm). Leaf length Fo.1 control is 13.48 cm and all of fomulas (26.11–28.85 cm). The plant stem length Fo.1 control is 7.11 cm and all of fomulas (11.96–12.96 cm). The plant stem color (with 5 the best) Fo.1 is 3 and all of fomulas (4.73–5/5). The plant leaf color Fo.1 control is 3 and all of fomulas from (4.73–5/5). All of fomulas compare the control is better. Statistical indicators that have significant differrences all of indicators with (α= 0.05) is α<0.05*. The number of plant branch did not have significant differences with α=0.17N. Biochar fertilizer can be used from the early stage when ST 25 rice plants start to be sown, until they grow and develop

in the fields in the Mekong Delta. It has the advantage of using wild reeds as organic fertilizer, contributing to environmental treatment and nurturing rice plants from the seedling stage to maturity.

Table 11. Mixed fertilizer of biochar, peat and inorganic.

Formulas	pH	C%	Humic Acid	OM%	N%	P%	K%	Ca%	Mg%	SiO
Fo.1a (5 days)	10.35	18.26	1.27	41.20	0.18	0.39	0.72	0.14	0.15	4.57
Fo.1b (10 days)	10.26	17.24	1.32	34.48	0.17	0.40	0.71	0.10	0.14	4.26
Fo.2a (5 days)	10.04	17.54	1.22	39.03	4.22	3.55	11.81	0.15	0.13	4.63
Fo.2b (10 days)	10.46	17.31	1.35	36.98	4.87	4.11	13.59	0.14	0.14	4.38
Fo.3a (5 days)	10.08	17.23	1.23	37.89	2.35	2.69	9.18	0.13	0.15	4.25
Fo.3b (10 days)	10.05	17.31	1.22	36.36	2.96	3.80	12.33	0.14	0.15	4.41
Fo.4a (5 days)	9.59	18.00	1.31	39.92	2.46	3.86	13.56	0.15	0.14	4.52
Fo.4b (10 days)	10.21	17.66	1.28	36.70	3.35	3.53	15.47	0.14	0.14	4.36
Fo.5a (5 days)	10.15	17.65	1.23	38.17	3.33	3.63	13.41	0.14	0.14	4.44
Fo.5b (10 days)	9.31	17.31	1.34	41.86	3.36	4.52	14.31	0.14	0.13	4.46
Fo.6a (5 days)	10.41	18.57	1.31	35.62	4.28	4.23	14.85	0.14	0.15	4.37
Fo.6b (10 days)	10.10	18.54	1.40	36.98	4.81	4.86	15.62	0.15	0.15	4.53
Fo.7a (5 days)	9.94	18.39	1.33	40.22	4.72	4.81	15.70	0.14	0.15	4.32
Fo.7b (10 days)	9.57	18.14	1.23	37.93	5.66	5.77	10.64	0.14	0.14	4.44
Fo.8a (5 days)	10.09	18.76	1.25	36.87	5.30	5.25	16.36	0.15	0.14	4.76
Fo.8b (10 days)	10.23	20.01	1.41	40.75	6.23	6.36	18.36	0.14	0.16	4.64
$\alpha = 0.05$	0.78N	0.83N	0.06N	0.00*	0.00*	0.00*	0.00*	0.64N	0.85N	0.00*

The dates after Mixed during 5 days and 10 days: Analized indicators are humic acid (%), organic matter OM(%), C (%), N(%), P(%), K(%), Ca(%), Mg(%), SiO_2(%).
(*) significant difference, (N)not significant difference.

Table 12. Rice growth indicators in experimental after 30 days of age.

Formula	H (cm)	NoBr.	Nosub-Br	Lle.	Stle.	Stco.	Lco.
Fo.1	22.55	3	1	13.48	7.11	3	3
Fo.2	36.34	3.96	1.56	27.70	12.26	5	5
Fo.3	36.44	4.03	2	28.85	12.96	5	5
Fo.4	35.96	3.56	1.33	27.04	12.52	5	5
Fo.5	36.63	3.04	1.04	26.78	11.96	4.85	4.85
Fo.6	35.89	3.48	1.37	25.89	12.59	5	5
Fo.7	36.56	3.37	1.37	26.78	12.55	5	5
Fo.8	36.56	3.56	1.44	26.11	12.67	5	5
Average	34.62	3.50	1.39	25.33	11.83	4.73	4.73
$\alpha = 0.05$	<0.00*	0.17N	<0.01*	<0.00*	«0.00*	<0.00*	<0.00*

(No.Br.) Number of branch;(No.subBr.) Number of sub branch; (L. le.) leaves length; (St. le.)Stem length; (St. co.) color of stem; (L. co.) color of leaves.
(*) significant difference, (N) not significant difference.

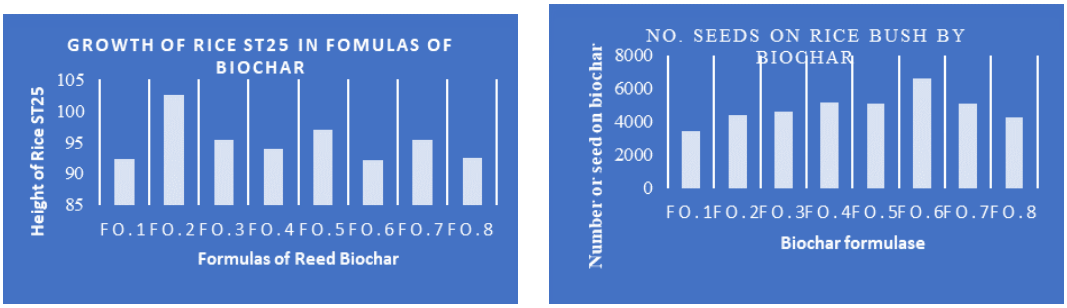
Rice growth indicators in eperimental fomulas fertilize after 75 days and measure after 125 days of age. The growth of rice plants in 8 fomulas showed (**Table 13**, **Figures 2** and **3**): The plant height Fo.1 control is 92.41 cm and all of fomulas (92.96–102.63 cm)[21] (the plant height (103–105 cm). The branch of bush Fo.1 control is 29.75 branch (Br) and all of fomulas from (31.19–34.48 Br) . The branch of plant Fo.1 is 10.52 Br. and all of fomulas (9.78–11.89 Br. The seeds of branch Fo.1 control is 107.59 seeds (Se.) and all of fomulas from (126.93–163.70 Se)[21] (the seed from 68–104 per branch and 27 the flat seeds per branch) . The seeds of bush Fo.1 control is 3425 Se and all of fomulas (4238–6.641 Se). The plant stem length Fo.1 is 72.22 cm and all of fomulas (72.30–82.00 cm). The flat of branch Fo.1 is 8.07 Se and all of fomulas (8.33–8.87 Se). The seed color Fo.1 is 4.78 (5 is best) and all of fomulas (4.63–4.93/5). The leaf color Fo.1 is 4.71 (5 is best) and all of fomulas (4.71–4.89); for other study can help growth by reed biochar[22]. The biochar group combine with inorganic fertilizer fomulas 1–4; Fomulas 4 have the seed highest is 5180 Se per bush, the Fo.2 have the

height growth is the best 102.63 cm, but the seed per bush only 4375 Se per bush. The biochar group combine with peat and ingranic formulas from Fo.5–Fo.7 with the height (92.26–95.33 cm) and the seed of bush (5090–6641 Se) per bush, especilaly fomulas 6 is the best with 6641 Se per bush. Statistical indicators that have significant differrences all of indicators with (α= 0.05) is α<0.05*. This research result allows us to develop agriculture with rice playing a key role in the Mekong Delta, reed biochar can be combined with inorganic mineral fertilizers and peat to create high-quality organic biochar fertilizer to create clean agriculture which is specifically used on ST 25 rice for high yield.

Table 13. Rice growth indicators in experimental formulas after 125 days of age.

Formula	H (cm)	Brbu.	Brpl.	Sebr.	Sebu.	Stle.	Flsebr.	Seco.	Lco.
Fo.1	92.41	29.75	10.52	107.59	3425	72.22	8.07	4.78	4.71
Fo.2	102.63	31.19	11.45	126.93	4375	71.96	8.15	4.93	4.93
Fo.3	95.48	35.74	11.33	134.59	4579	72.30	8.33	4.89	4.89
Fo.4	93.89	33.33	10.92	158.66	5180	73.66	8.59	4.85	4.85
Fo.5	96.96	32.67	11.15	152.22	5090	72.48	8.48	4.89	4.89
Fo.6	92.26	34.11	11.89	185.37	6641	82.00	8.71	4.89	4.89
Fo.7	95.33	34.48	10.41	163.70	5106	78.93	8.33	4.71	4.71
Fo.8	92.48	31.81	9.78	144.48	4238	72.59	8.87	4.63	4.63
Average	95.18	35.38	10.93	146.69	4829	74.52	8.49	4.84	4.81
$\alpha = 0.05$	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.00*	<0.05*	<0.02*

H(cm) height of plant; Br.bu. branches of bush; Br.pl. branches of plant; Se.br. seeds of branch; Seeds of bush; St.le. length of stem; Fl.se.br. Flat seeds of branch; Se.co. Corlor of seeds; L.co. color of leaves.
(*) significant difference, (N) not significant difference.



(**A**) Growth of rice (**B**) No. Seeds on rice bush

Figure 2. Height Growth and seed number of Rice ST 25 on Reed Biochra Fomulas.

(**A**) Growth state (**B**) Ripe state (**C**) Wide model

Figure 3. Rice ST 25 use Reed biochar and model of using biochar fertilizers.

4. Discussions

Density of reed is 60 plants per square meters (pl./m^2), the mount of dry material from reeds is 65 g per plant (g/pl), the annual harvest is 3.9 kg per square meters (kg/m^2), equivelent to 39,000 kg per hectare(kg/ha), with a density of 60 pl/m^2, the mount of biochar from reeds is 13,59 g/pl, the annual harvest is 0.815 kg/m^2, equivelent to 6,642 kg/ha, it is very significant biological mass this allows the economic potential for environmental and agricultural raw materials to to be exploited economically.

Weight of reed trunk is 7.62 g/pl, it is highest among the reed parts, this indicator allows to evaluate its potential in this population biomass; chemical indicators of reeds trunk pH is 10, it can improve acid sulfat soil; OM % is 34.48 %, rate is very high as use for organic fertilizer; inicators as N %, P %, K % accounting for less than 1%, it is necessary to suplemnt inorgrnic minerals to increase fertilizer efficiency; weight of the reed leaves is 4.23 g/pl, it is high among the reed parts; chemical indicators of reeds trunk pH is 10, this thing can improve acid sulfat soil; OM % is 35.75 %, rate is very high so use for organic fertilizer; the inicators as N %, P %, K % accounting for less than 1%, it is necessary to supplement inorgrnic minerals to increase fertilizer efficiency; weight of the reed flower is 4.23 g/pl, is small among the reed parts; chemical indicators of reeds flower pH is 10, this thing can improve acid sulfat soil; OM % organic mater is 40.23 % this rate is very highest so use for organic fertilizer; the inicators as N %, P %, K % accounting for less than 1%, so it is necessary to suplemnt inorgrnic minerals for fertilizer efficiency. The chemical composition on reed biochar shows that pH is 9.89 which can be applied as fertilizer to improve acid sulfate soil; C % is 18.41 %, OM % is 36.82 % which are important parts in organic fertilizer; SiO % is 4.64% it can improve the physical soil; except humic acid %, N %, P %, K % are needed to be supplemented when using it as organic fertilizer; this discovery is very necessary for the meaning of clean agricultural economic development for the Mekong Delta. In other study it can improve the soil conditions [23].

Research show peat chemical with pH, N %, P %, K %, SO_4^{2-} very low, with Fe^{2+} is high, it can make the soil acidic due to high alum; but humic acid averages up to 13 % and NH_4^+ is 16.7 %, when used with organic fertilizers it can contribute to plant growth; when using peat with reed biochar, it will neutralize the soil, promoting the effectiveness of fertilizers from peat and biochar.

Adsorption of pig urine with nitrate and ammonium wastewater causing environmental emissions was studied by filtering through biochar. This study helps determined the amount of NO^{2-}, NH_4^+ that can be obtained through the amount of reed biochar, contributing to the treatment of environmental pollution and increasing the amount of nitrogen for biochar fertilizer to provide plants. Ít results has the following implications: in livestock farming, pig urine will cause environmental pollution from the emission of NH_4^+, NO^{2-}, NO^{3-}; the study will quantify the level of environmental waste adsorption in pig wastewater; furthermore, the content obtained waste from N%, P%, K% inorganic matter, NH_4^+, $NO^{2-}$and NO^{3-} will let us know that when composting biochar with wastewater, a certain amount of nutrients will be obtained in livestock farming; contribute to solving environmental pollution but also increase productivity in agriculture. Results on the adsorption of inorganic mineral fertilizers has economic significance in determining the amount of inorganic fertilizer solution needed when mixed with biochar, so that this amount is not too much when producing effective biological organic fertilizers for crops; It was found there were difference in the adsorption rates of N, P, K is the biochar increased like effective of reed biochar loses [24].

This results is meaningful for us to know, after producing fertilizer from the combination of inorganic and organic fertilizers with a long storage time of up to 10 days in nature without preservation, can it evaporate and lose the content of N%, P%, K% that we mixed? so that we know when storing inorganic fertilizers in nature without preservation. Growth indicators are clearly different when mixing biochar with peat and inorganic mineral fertilizers by many fomulas, measure after 30 days compare with control few fomulas result are quite promising for fertilizer biochar in the future like in the study [25] and blue growth [26] Biochar fertilizer can be used from the early stage when ST 25 rice plants start to be sown, until they grow and develop in the fields in the Mekong Delta. It has the advantage of using wild reeds as organic fertilizer, contributing to environmental treatment and nurturing rice plants from the seedling stage to maturity. This research result allows us to develop agriculture with rice playing a key role in the Mekong Delta, reed biochar can be combined with inorganic mineral fertilizers and peat to

create high-quality organic biochar fertilizer to create clean agriculture which is specifically used on ST 25 rice for high yield. For the yeild indicator the fomulas 5–7 has over 5000 Se per bush, fomulas 6 has 6600 Se per bush, meanwhile fomulas 4 has 5180 Se per bush also fomula the high yield inorganic mineral fertilizer; it can grow the rice and also planting watermelon [27].

5. Conclusions

Density of reeds (*Phragmites australis*) is 60 plants per square meters and mount of dry reeds is 65 g/pl, harvest is 3.9 kg/m^2 to 39,000 kg/ha; the mount of biochar of reeds is 13,59 g/pl, the annual harvest is 0.815 kg/m^2 equivelent to 6,642 kg/ha is very high with biological mass, this allows the economic potential for environmental and agricultural raw materials to to be exploited economically.

Weight of reed trunk is 7.62 g/pl, it is highest among the reed parts of this population biomass, chemical indicators of reeds trunk, leaves and flowers with pH are 10, it can improve acid sulfat soil inMekong Delta very sccessfully; OM % organic mater of trunk, leaves, flowers is 34.48%, 35.75%, 40,23% these rates are very high so use for organic fertilizer is very good; the indicators of N %, P %, K % accounting for less than 1%, so it is necessary to suplemnt inorgrnic minerals from these substances to increase fertilizer efficiency when use them product organic fertilizers..

The chemicla of peat with pH, N %, P %, K %, SO_4^{2-} are very low, higher is Fe^{2+}, it made the soil acidic due to high alum; humic acid averages up to 13% and NH_4^+ is 16.7%, so used with organic fertilizers it can contribute to plant growth; using peat with reed biochar, it will neutralize the soil, promoting the effectiveness of fertilizers from peat and biochar to make organic fertilizers in agriculture..

The adsorption of pig urine with nitrate and ammonium wastewater causing environmental emissions was studied by filtering through biochar, the amount of NO^{2-}, NH_4^+ that can be obtained through the amount of reed biochar, contributing to the treatment of environmental pollution; research on the adsorption of inorganic mineral fertilizers has economic significance in determining the amount of inorganic fertilizer solution needed when mixed with biochar, so that this amount is not too much when producing effective biological organic fertilizers for crops.

After producing fertilizer from the combination of inorganic and organic fertilizers (Biochar of reed, peat, and NPK inorganic fertilizers) with a long storage time of up to 10 days in nature without preservation, the evaluation of evaporation and loss of N%, P%, K% is not change; Biochar fertilizer can be used from the early stage when ST 25 rice plants start to be sown, until they grow and develop in the fields, reed biochar can be combined with inorganic mineral fertilizers and peat to create high-quality organic biochar fertilizer to create clean agriculture which is specifically used on ST 25 rice for high yield.

Author Contributions

Conceptualization, L.T.T.; methodology, M.D., L.T.T.; software, M.D., N.T.H.D., T.V.N., F.S.M..; validation, L.T.T., M.D., T.V.N.; formal analysis, L.T.T., N.T.H.D., T.V.N., F.S.M.; investigation, L.T.T., T.V.N.; resources, L.T.T., M.D., T.V.N.; data curation, L.T.T., M.D.; writing-original draft preparation, L.T.T.; writing—review and editing, L.T.T.; visualization, L.T.T.; supervision, L.T.T.; project administration, L.T.T.; funding acquisition, L.T.T., M.D. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The research has received an ethical review and information about passing the ethical review from Faculty of Natural resources and Environment of Kien Giang University dr. Nguyen Van Thanh director of Kien Giang University approved 12. 2023 number KGU1-B2024.

Informed Consent Statement

Where data supporting reported results can be found Kien Giang University, U Minh Thương National Park, De-

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Confict of Interest

All the authors declare that there are no conflicts of interest.

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