Hamparan perak paddy local cultivar performance applied with biochart and planting distance as multiple crop between row of one year old hevea

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Abstract. The low price of natural rubber in last 10 years has the impact on low income of the smallholder rubber plantation. Intensity of tapping and management of Hevea crop had decreased. In other side, space between rows of Hevea could be managed to produce food when Hevea in Immature Periods, hence could be beneficial to the smallholder rubber plantation. This research evaluated paddy land local cultivar, Hamparan Perak, which produce the red rice, applied by biochart created from Hevea seed shell. Research was conducted with 12 combination treatments in 1x1 m² plot size. Biochart with 0 kg/plot, 0.5 kg/plot, and 1.5 kg/plot, combined with planting distance 20x20 cm, 25x25 cm and 30x30 cm of Hamparan Perak cultivar. Results found that biochart had significant effect on amount of panicles, but it was not significantly different effect on growth and yield. Planting distances had significant effects on crop height and amount of tillers but were not significantly different on 1000 grain weight and grain yield. Biochart has long term effects, hence it will be valuable for Hevea. The research still continue to the known growth and yield of paddy land due to the growth of Hevea canopy.

1. Introduction
In last 10 years, low price of natural rubber as the reason for the small holders of Hevea that had low income, even they could not estate maintances. This fact needs to be solved by multiple cropping in space between hevea immature rows. In Indonesia, 45 – 80 million ha of projectile immature hevea may contribute to increase income of the small holders of hevea and also contribute for the food national stock [1]. One of high potencial food crop that could be managed is paddy land, including red rice. The red rice has high nutrient, high fiber, vegetable oil and fat essential caused by seed grinding processing [2]. Hamparan Perak, local cultivar or paddy land produce the red rice as the potential cultivar to be evaluated as a food crop managed in space between hevea immature rows.

To ameliorate of soil which has used more than 20 years, application of projectile biochart will be valuable for hevea and paddy land. Specifically, biochart created by hevea seed coat which fall peridocally as an approach based on agroecology. Biochart is charcoal activated by chemical and physical process. Biochart application in soil may increase C-soil, water retension and soil nutrient, increase of cation and Phospor and can rehabilitate soil degradation [3]. Application of 0.4 – 0.8 tonnes biochart/ha could increase crop yield 20 -22% [4].

This research is done to know Hamparan Perak cultivar’s responses by applying the biochart of hevea seed coat raw materials, combined with planting distance in space of hevea rows. Results of the
research of some red rice paddy lands and *hevea* performances in the first year of planting have been reported by [5], also reported in management and economic aspects by [6].

2. Methodology
The research was conducted on May–November 2018, in Sampali Estate, Deli Serdang, North Sumatera Province. The research was designed as Factorial Block Design with 2 factors which were B0 = without biochart, B1 = 0.5 kg biochart/plot, B2 = 1 kg biochart /plot, B3 = 1.5 kg biochart/plot, combined with J1 = paddy distance 20 x 20 cm, J2= paddy distance 25 x 25 cm and J3 = paddy distance 30 x 30 cm. Plot size was 1 x 1 m in space between *hevea* rows. The treatments replicated 3 times.

![Figure 1. Treatment plots](image1)

![Figure 2. Biochart of seed coat *hevea* raw material processing](image2)

Parameters to be observed were crop height (cm), the amount of tillers (tillers), amount of panicles (panicles), grain eeeight per crop (g), grain yield per plot (g), and 1000 grain weight (g).

3. Result and discussion

3.1. Crop height
Table 1 shows that biochart did not signficantly effect on crop height in 2 - 6 Weeks After Sowing (WAS). Planting distance had significant effect on crop height in 2 and 3 WAS, but it not significantly different effect in 4 - 6 WAS. Table 1 also shows that combination treatments were not significantly different effect on crop height.

Based on this parameter, biochar may ameliorate soil condition in long term, and not as the direct material to provide nutrients. Biochart act as ameliorate of physicochemical and biological of soil. Application of biochart may increase cation, total N, P and cation exchange capacity [7].
3.2. Amount of tillers
Table 2 shows average amount of tillers Hamparan Perak cultivar, cause application of biochar, planting distance and combination of both.

Placing distance 30 x 30 cm (J3) gave the significant effect in amount of tillers compared with planting distance 25 x 25 cm (J2), even not significantly different effect with 20 x 20 cm (J1) in 3 WAS (Table 2). Ini 4 - 6 WAS, 30 x 30 cm (J3) had significant effect in amount of tillers compared with 20 x 20 cm (J1) and 25 x 25 cm (J2).

It may concluded that in short term, space to the growth is more important and direct influence to paddy land than bioachart. Biochart has proved had the long term effect and undirectly influence the paddy growth [7].

3.3. Amount of panicles
Application of biochart 1.5 kg per plot (B3) produced highest amount of panicles (28.69 panicles), which was significantly different compared with 0.5 kg per plot (B1) and without biochart (B0), and it was not significantly different effect with 1 kg per plot (B2). For planting distance aspect, 30 x 30 cm (J3) produced highest amount of panicles (28.67 panicles), which was significant effect compared with amount of panicles produced by 20 x 20 cm (J1), and it was not significantly different effect compared with amount of panicles produced by 25 x 25 cm (J2).

Placing distance proved influence length of panicles and amount of grain per panicle [9]. For paddy sawah, planting distance reccomended 25 cm (between row) x 12.5 cm (in row) and 50 cm

Table 1. Average of crop height Hamparan Perak cultivar caused application of biochar and planting distance 2 - 6 weeks after sowing

| Treatments | 1 WAS | 3 WAS | 4 WAS | 5 WAS | 6 WAS |
|------------|-------|-------|-------|-------|-------|
| B0         | 11.69 | 17.76 | 22.42 | 30.34 | 40.7 |
| B1         | 11.79 | 17.27 | 22.1  | 27.73 | 39.92 |
| B2         | 12.56 | 17.64 | 22.51 | 28.09 | 40.31 |
| B3         | 12.54 | 18.47 | 23.98 | 29.70 | 39.08 |
| J1         | 12.25 | 18.15 | 23.4  | 28.73 | 38.78 |
| J2         | 11.23 | 16.24 | 22.08 | 29.71 | 41.64 |
| J3         | 12.96 | 18.94 | 22.78 | 28.47 | 39.58 |

WAS: week after showing
B0= without biochart,B1= 0.5 kg bioachart/m², B2= 1 kg biochar/m², B3=1.5 kg biochar/m²,
J1 = paddy 20x20 cm, J2 = paddy 25x25 cm J3= 30 x 30 cm

Remarks : number followed by the same alphabetic in the same column not significantly different effect based on α 0.5 (small alphabetic) and α. 0.1 (capital alphabetic)
(alley distance) (Balai Benih Padi, 2012). Based on these parameters, paddy land could be planting with 30 x 30 cm distance.

**Table 2.** Average amount of tillers Hamparan Perak cultivar caused application of biochart and planting distance 3 till 6 weeks after sowing

| Treatment | Average amount of tillers |
|-----------|---------------------------|
|           | 3 WAS        | 4 WAS        | 5 WAS        | 6 WAS        |
| B0        | 0.76<sup>a</sup> | 4.69<sup>a</sup> | 9.71<sup>b</sup> | 15.36<sup>b</sup> |
| B1        | 1.09<sup>b</sup> | 4.91<sup>b</sup> | 9.56<sup>b</sup> | 16.58<sup>b</sup> |
| B2        | 0.91<sup>b</sup> | 4.67<sup>b</sup> | 9.80<sup>b</sup> | 16.42<sup>b</sup> |
| B3        | 1.02<sup>b</sup> | 4.89<sup>b</sup> | 9.44<sup>b</sup> | 15.84<sup>b</sup> |
| J1        | 1.05<sup>abA</sup> | 4.38<sup>ab</sup> | 8.72<sup>ab</sup> | 13.62<sup>ab</sup> |
| J2        | 0.70<sup>Aa</sup> | 4.12<sup>ab</sup> | 8.57<sup>ab</sup> | 13.98<sup>ab</sup> |
| J3        | 1.08<sup>abA</sup> | 5.87<sup>ab</sup> | 11.6<sup>aA</sup> | 20.55<sup>aA</sup> |
| B0J1      | 0.87         | 4.27         | 8.33         | 12.60         |
| B0J2      | 0.67         | 4.53         | 9.33         | 12.80         |
| B0J3      | 0.73         | 5.27         | 11.47        | 20.67         |
| B1J1      | 0.87         | 4.0          | 8.33         | 13.67         |
| B1J2      | 0.93         | 4.27         | 8.60         | 13.87         |
| B1J3      | 1.47         | 6.40         | 11.73        | 22.20         |
| B2J1      | 1.27         | 4.53         | 9.20         | 14.07         |
| B2J2      | 0.60         | 3.73         | 8.00         | 14.07         |
| B2J3      | 0.87         | 5.73         | 12.20        | 21.13         |
| B3J1      | 1.20         | 4.67         | 9.00         | 14.13         |
| B3J2      | 0.60         | 3.93         | 8.33         | 15.20         |
| B3J3      | 1.27         | 6.07         | 11.00        | 18.20         |

WAS: week after planting
B0= without biochart, B1= 0.5 kg biochar/m<sup>2</sup> B2= 1 kg biochar/m<sup>2</sup>, B3=1.5 kg biochar/m<sup>2</sup>, J1 = paddy 20x20 cm, J2 = paddy 25x25 cm J3= 30 x 30 cm

Remarks: number followed by the same alphabetic in the same column not significantly different effect based on α 0.5 (small alphabetic) and α. 0,1(capital alphabetic)

3.4. Grain weight
Grain weight did showed significant different effect by combination of biochar and planting distance. Table 3. showed that highest grain weight produced in 1.5 kg biochar combined with 30 x 30 planting distance (B3J3), even not significantly different effect when compared with others combination treatments. Amount of grain and grain weight mainly influenced by water availability in reproductive phase [10]. [11] concluded that planting distance had high effect on panicles growth. The precise planting distance will produce high grain caused maximum growth, amount of tillers and panicles growth.
Table 3. Average of panicles amount, grain weight, and 1000 grain weight Hamparan Perak cultivar caused application of biochart and planting distance

| Treatment | Panicles per crop (panicle) | Grain per crop (g)** | Grain per plot (g)** | 1000 grain weight (g)** |
|-----------|-----------------------------|----------------------|----------------------|-------------------------|
| B0J1      | 19.67                       | 25.40                | 383.80               | 22.67                   |
| B0J2      | 22.27                       | 26.40                | 365.67               | 24.00                   |
| B0J3      | 27.00                       | 26.40                | 315.45               | 25.00                   |
| B1J1      | 23.47                       | 27.67                | 432.33               | 25.33                   |
| B1J2      | 26.53                       | 26.60                | 387.67               | 24.26                   |
| B1J3      | 28.33                       | 27.07                | 395.78               | 26.14                   |
| B2J1      | 26.13                       | 25.93                | 422.50               | 25.00                   |
| B2J2      | 28.80                       | 29.60                | 443.27               | 26.67                   |
| B2J3      | 30.67                       | 28.07                | 343.17               | 25.30                   |
| B3J1      | 27.73                       | 26.87                | 410.83               | 24.08                   |
| B3J2      | 29.67                       | 28.73                | 427.67               | 27.45                   |
| B3J3      | 28.67                       | 29.87                | 388.67               | 27.37                   |

B0= without biochart, B1= 0.5 kg biochart/m², B2= 1 kg biochart/m², B3=1.5 kg biochart/m², J1 = paddy 20x20 cm, J2 = paddy 25x25 cm, J3= 30 x 30 cm

**B**, **J**, **BxJ**ns

3.5. Grain weight per plot
Combination treatment of biochart and planting distance not significantly different effect produced grain weight per plot. When Hamparan Perak cultivar was enter to generatif phase, most birds seen as the main factor pest to decreased grain per plot. Based on field condition, this pest estimated lost 30% of grain.

3.6. 1000 grain weight
Combination of biochart and planting distance didn’t produce significant effect of 1000 grain weight. The heighest 1000 grain weight produced by 1.5 kg biochart per plot in 25 x 25 cm planting distance (B3J2) (27.45 g), and the lowest 1000 grain weight produced by without biochart in 20 x 20 cm planting distance (22.71 g). 1000 grain weight mainly influenced by environmental condition when paddy entered to generative phase. Filled out of grain determined by water availability and physiology process to fill the grain.

3.7. Some obstacles

3.7.1. Bird pest. Bird observated as the main pest in this research. Using the nets could be said too late. This obstacle could be managed well before paddy enter to generative phase.
3.7.2. Weeds. High growth some weeds also the other obstacle in field. Predicted, application of biochart stimulate more response in weeds growth.

Table 4. Weeds dominance on research field

| No | Family       | Species                        | Dominance (%) |
|----|--------------|--------------------------------|---------------|
| 1  | Compositae   | *Ageratum conyzoides* L         | 10            |
|    |              | *Mikania cordata*               | 10            |
| 2  | Cyperaceae   | *Cyperus rotundus* L            | 30            |
|    |              | *Cyperus killingia*             |               |
|    |              | *Gleichenia linearis* Clarke.   | 20            |
|    | Gleicheniaceae|                                |               |
|    | Gramineae    | *Axonopus compressus* P.B.      | 10            |
|    |              | *Paspalum vaginatum*            | 5             |
|    | Melastomataceae| *Melastoma affine*              | 5             |
|    | Polygalaceae | *Polygala paniculata* L.        | 5             |
|    | Others       |                                | 5             |

Source: Siregar et.al (2018)

4. Conclusion
Based on result and discussion, could be concluded that one period of paddy management as multiple crop between *Hevea* rows applied by biochart generally did not influence many parameters. Planting distance showed significant effect in 2 and 3 WAS by combination of biochart and planting distance, and it was not significantly different effect in 4, 5 and 6 WAS. Numbers of panicles had significant effect on biochart and planting distance treatment, but it was not significantly different effect by combination treatment. Grain yield per plot, grain weight per crop, and 1000 grain weight were not significantly different effect by biochart, planting distance and combination of both. The research still continue to observe many factors of multiple cropping paddy land and *hevea*.

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