# Effect of cucumber (*Cucumis sativus* L.) biomass and nitrogen level on weed suppression and yield of transplant *aman* rice cv. BR11

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**Abstract:** An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University to study the effect of cucumber (*Cucumis sativus* L.) biomass and nitrogen level on weed suppression and yield and yield components of T. *aman* rice cv BR11**.** The study consists two treatments, viz. - i) cucumber green biomass (0, 2.5, 5.0 t ha$^{-1}$) and ii) nitrogen level (17.5 kg N ha$^{-1}$ (25% of the recommended dose), 35 kg N ha$^{-1}$ (50% of the recommended dose), 70 kg N ha$^{-1}$ (100% of the recommended dose). Cucumber biomass was incorporated in the field as per experimental treatments before 7 days of rice transplanting while urea was applied as per experimental treatments in two equal installments (20 and 40 DAT). Cucumber biomass had significant influence on weed density and dry weight and those parameters were found lowest when 5 t ha$^{-1}$ cucumber biomass was incorporated in the rice plots. In contrast, highest weed density and dry weight were observed when no cucumber biomass was applied. Cucumber biomass @ 5 t ha$^{-1}$ with 35 kg N ha$^{-1}$ showed the best performance in reducing weed density, weed dry weight and increased weed control efficiency. On the other hand, highest grain yield (5.67 t ha$^{-1}$) was obtained from the application of 5 t ha$^{-1}$ cucumber biomass with 70 kg N ha$^{-1}$ (100% of the recommended dose). Whereas the lowest grain yield (3.07 t ha$^{-1}$) was observed from the treatment of no cucumber biomass incorporation along with 17.5 kg N ha$^{-1}$ (25% of recommended dose). From the results of the study, it may be concluded that green biomass cucumber @ 5 t ha$^{-1}$ with 70 kg N ha$^{-1}$ showed the best performance in weed control and yield of *T. aman* rice.
**Key words**: BR11 rice, Cucumber green biomass, Nitrogen level, Rice yield.

## Introduction

Cucumber *(Cucumis sativus)* is the fourth most widely cultivated vegetable crop in the world after tomatoes, cabbage and onions (Shetty and Weliner, 2002). It is an important vegetable in Bangladesh. Acreage and production of cucumber in Bangladesh were 1939 thousand ha and 32480 thousand m tons respectively, in 2006-2007 (BBS, 2008). After harvesting, the plant parts of cucumber (stems, leaves and roots) are mostly discarded. It has been reported that cucumber residues can provide excellent weed suppression after the incorporation of their residues into the soil (Putnam and Duke, 1974; Yu and Matsui, 1994; 2000; Kato-Noguchi *et al.,* 2002; Yu *et al.,* 2003; Thi *et al.,* 2008). However, so far, no studies had been done to exploit the allelopathy of cucumber *(Cucumis sativus L.)* for possible weed control purposes in Bangladesh.

Rice is the principal food crop of Bangladesh. It occupies 11.41 million hectares of land which is about 75.61 percent of the cultivated area (BBS, 2013). The population of Bangladesh will increase to 173 million in 2020 and to feed the increased population by 2020, 47 million tons of rice will be needed to produce. But, the average yield of rice in Bangladesh is 2.92 t ha$^{-1}$ (BBS, 2013). This yield is much lower than that of other rice growing countries like Japan (6.8 t ha $^{1}$), Korea (6.8 t ha$^{-1}$) and China (6.3 t ha$^{-1}$) (IRRI, 2005). Among the various factors responsible for low rice production, weeds are considered to be as one of the major limiting factors due to manifold harmful effects. In Bangladesh 40.28% rice yields lost due to weed competition (Karim et. *al.,* 1998). Weed infestation reduces the grain yield by 70-80% in *aus* rice (early summer), 30-40% for transplant *aman* rice (late summer) and 22-36% for modern *born* rice cultivars (winter rice) (BRRI, 2012) in Bangladesh. Among the rice weeds, *Echinochloa crusgalli, Echinochloa colonum, Cyperus difformis, Fimbristylis miliacea, Fimbristylis littorails, Cyperus iria, Monochoria vaginalis and Monochoria hastata are* the most significant biological constraints to rice production. Subsistence farmers of tropics like to spend more time, energy and money on weed control. In spite of the wide use of commercial herbicides to control rice weeds, the yield loss from weed remains high. The negative impacts of commercial herbicide use such as environmental contamination and development of herbicide-resistant weeds make it necessary to diversify weed management options (Putnam 1988; Einhellig, 1999). Controlling weeds through allelopathy is one of the strategies for reducing commercial herbicide dependency and for environmentally friendly sustainable weed management (Rice 1984; Putnam 1988; Duke *et al.,* 2000). It has been observed that cucumber *(Cucumis sativus)* can provide excellent weed suppression after the incorporation of their residues into the soil of rice field (Caamal-Maldonado *et al.,* 2001).

Judicious fertilizer management is one of the most important aspects of rice production and among the fertilizers nitrogen is the major essential plant nutrient and key input for rice production and increasing yield in Bangladesh. Application of urea-N plays a vital role in vegetative growth, development and yield of rice. Yield increases 70-80% of field rice could be obtained by the judicious application of nitrogenous fertilizer (IFIC, 2007).

With the above views in mind, the present study was, therefore, undertaken to (i) assess the effect of cucumber biomass on weed suppression and the performance of transplant *aman* rice cv. BR 11, to see the effect level of N on weed growth and the yield and yield components of transplant *aman* rice cv. BR11 and (iii) to evaluate the interaction effect of cucumber biomass and level of N on weed growth and yield and yield components of transplant *aman rice* cv. BR11.

## Materials and Methods

The experimental field belongs to the non-calcareous dark grey floodplain soil (Old Brahmaputra Alluvial Soil Tract) under the Old Brahmaputra Floodplain Agro Ecological

Zone-9. The experimental field was medium high land with loamy soil having pH value of 6.5. Soil contained 1.027% organic matter, 0.09% total nitrogen, 5.68 ppm available phosphorus, 49.12 ppm exchangeable potassium and 8.28 ppm available sulphur. consists two factors, Factor A: Cucumber biomass (green): 0 t $ha^{-1}$ (control) - $C_0$, 2.5 t $ha^{-1}$- $C_1$ and 5.0 t $ha^{-1}$- $C_2$, Factor B: Nitrogen level: 25% of the recommended dose of N (17.5 kg N $ha^{-1}$) - $N_1$, 50% of the recommended dose of N (35 kg N $ha^{-1}$) - $N_2$ and 100% of the recommended dose of N (70 kg N $ha^{-1}$) - $N_3$. The experiment was laid out in a randomized complete block design with three replications. All the treatments were randomly allocated in the respective plots. Each replication was divided into 9 unit plots (4.0 m× 2.5 m). Thus the total number of unit plots was 27 (3×3×3). The distances maintained between replications and plots were 2.0 m and 1.0 m, respectively. The layout of the experiment was done on 20 July 2014. A piece of high land was selected at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh for raising seedlings. Sprouted seeds were sown in the wet nursery bed on 28 June 2014. The land was prepared thoroughly by tilling once with a power tiller and subsequently ploughing three times with country plough followed by laddering. The experimental field was laid out on 20 July 2014 according to the design. Cucumber biomass was incorporated in the field on 21 July 2014 as per experimental treatments. Urea was applied as per experimental treatments. One-third urea was applied at the time of final land preparation. Rest urea was top dressed in two equal installments at 20 DAT (17 August 2014) and 35 DAT (6 September 2014). The experimental field was also fertilized with 55kg TSP, 85 kg MoP, 60 kg gypsum and 10 kg $ZnSO_4$ $ha^{-1}$ as basal dose. Uprooted seedlings were transplanted in the unit plots on 28 July 2014 at the rate of three seedlings $hill^{-1}$ maintaining a spacing of 25 cm × 15 cm. Weed and stubbles were removed as and when necessary. When 80-90% of the grains became golden yellow color, the crop was considered to be matured. Crop was harvested on 26 November 2014. Five hills (excluding border hills) were selected randomly from each experimental plot to record necessary data. An area of 1 $m^2$ was selected in the middle portion of each plot to record the yield of grain and straw. The harvested crop of each plot was separately bundled, properly tagged and then brought to the clean threshing floor. The crop was threshed with a pedal thresher. Grains were then sun dried at 14% moisture level and cleaned. Straws were also sun dried properly. Finally grain and straw yields per plot were recorded and converted to t $ha^{-1}$. Data were collected on weed density (number $m^{-2}$) and dry weight (g $m^{-2}$), plant height (cm), number of total tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of grains $panicle^{-1}$, 1000-grain weight (g), grain yield (t $ha^{-1}$), straw yield (t $ha^{-1}$) and harvest index (%). The collected data were compiled and tabulated in proper form and subjected to statistical analysis. Data were analyzed using the analysis of variance technique with the help of computer package program MSTAT-C and mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

## Results and Discussion

**Effect of cucumber biomass on weed:** Cucumber biomass had significant effect on weed density and dry weight (Table 1). Weed density (number $m^{-2}$) was highest (14.67) in no application (0 t $ha^{-1}$) of cucumber biomass at 25 DAT and 50 DATs (12.00). Weed density was lowest (6.33) when 5 t $ha^{-1}$ cucumber biomass was incorporation at 25 DAT and 50 DATs (6.33). So it is clearly evident that incorporation of cucumber biomass reduced the weed density. This was might be due to allelopathic effect of cucumber which inhibited the weed seed germination in the field. The lowest amount of weed biomass was obtained when 5 $tha^{-1}$ cucumber biomass was incorporated both at 25 DAT (3.57 $gm^{-2}$) and 50 DAT (11.30 $gm^{-2}$). For 2.5 $tha^{-1}$ cucumber biomass incorporation weed dry weight at 25 DAT was 5.22 g $m^{-2}$ and in 50 DAT weed dry weight was 13.96 $gm^{-2}$ which were statistically similar to the results found in 5 $tha^{-1}$ cucumber biomass incorporation. The highest amount of weed dry weight was found in the plots where no cucumber biomass was applied. So it clearly shows that cucumber biomass reduced the weed dry weight. This was might be due to allelopathic effect of cucumber biomass which reduced the weeds growth and development in the rice field. Cucumber biomass suppressed weeds that were present in the field. Cucumber biomass incorporated in the rice field released some allelochemicals in the soil which inhibited weed seed germination and reduced the weed growth.

**Table 1.** Weed density and dry weight as influenced by cucumber biomass

| Cucumber biomass (t $ha^{-1}$) | Weed density (number $m^{-2}$) | | Weed dry weight (g $m^{-2}$) | |
|---|---|---|---|---|
| | 25 DAT | 50 DAT | 25 DAT | 50 DAT |
| 0 | 14.67a* | 12.00a | 10.58a | 18.94a |
| 2.5 | 9.78b | 8.67b | 5.22b | 13.97b |
| 5.0 | 6.33c | 6.33b | 3.57c | 11.30b |
| CV (%) | 25.21 | 31.67 | 20.73 | 25.43 |
| Level of significance | 0.01 | 0.01 | 0.01 | 0.01 |

In a column figures having common letter (s) do not differ significantly

**Effect of level of N on weed:** Level of nitrogen had no significant effect on weed density and dry weight of barnyardgrass (Table 2). Numerically 100% recommended dose of N (60 kg $ha^{-1}$) has the highest weed density and dry weight at 25 DAT and 50 DAT. This indicated that application of sufficient N might enhance the growth of barnyardgrass.

**Interaction effect of cucumber biomass and level of nitrogen on weed:** Cucumber biomass and level of nitrogen had significant effect on rice weed especially barnyardgrass (Table 3). The highest weed density and dry weight were obtained from the interaction effect of no

cucumber biomass ×100% recommended doses of N at 25 and 50 DATs. The lowest values were obtained from the interaction of application of 5 t ha$^{-1}$ cucumber biomass × 25% of the RD of N.

**Table 2.** Weed density and dry weight as influenced by level of nitrogen

| Cucumber biomass (t ha$^{-1}$) | Weed density (no. m$^{-2}$) | | Weed dry weight (g m$^{-2}$) | |
|---|---|---|---|---|
| | 25 DAT | 50 DAT | 25 DAT | 50 DAT |
| 0 (Control) | 8.78 | 9.56 | 5.727b* | 14.35 |
| 50% of the RD | 11.56 | 8.22 | 5.42b | 14.42 |
| 100% of the RD | 10.44 | 9.22 | 8.21a | 15.42 |
| CV (%) | 25.21 | 31.67 | 0.4462 | 25.43 |
| Level of significance | NS | NS | 0.01 | NS |

In a column figures having common letter(s) do not differ significantly, RD = Recommended dose.

**Table 3.** Wed density and dry weight as influenced by interaction effect of cucumber biomass and level of nitrogen.

| Interaction of Cucumber biomass × N level | Weed density (no. m$^{-2}$) | | Weed dry weight (g m$^{-2}$) | |
|---|---|---|---|---|
| | 25 DAT | 50 DAT | 25 DAT | 50 DAT |
| $C_0N_1$ | 13.33a* | 11.00ab | 8.63b | 18.66ab |
| $C_0N_2$ | 14.33a | 11.67ab | 7.58bc | 19.96abc |
| $C_0N_3$ | 16.33a | 13.33a | 15.54a | 21.19a |
| $C_1N_1$ | 8.33b | 11.00ab | 6.05cd | 13.48bc |
| $C_1N_2$ | 13.00a | 7.67bc | 5.28cde | 13.47bc |
| $C_1N_3$ | 8.00b | 7.33bc | 4.32def | 14.95abc |
| $C_2N_1$ | 4.6b | 6.67bc | 2.50f | 10.91c |
| $C_2N_2$ | 7.33b | 5.33c | 3.41ef | 12.83bc |
| $C_2N_3$ | 7.00b | 7.00bc | 4.79def | 10.14c |
| level of significance | 0.05 | 0.05 | 0.01 | 0.05 |
| CV % | 0.05 | 0.05 | 0.01 | 0.05 |

In a column figures having common letters (s) do not differ significantly , $C_0$ = No cucumber biomass (control), $C_1$ = 2.5 tha$^{-1}$, $C_2$ = 2.5 tha$^{-1}$, $N_1$ = 25% of the RD, $N_2$ = 50% of the RD, $N_3$ = 100% of RD, RD = Recommended dose.

**Yield and yield contributing characters of T. *aman* rice**

**Effect of cucumber biomass:** Plant height was not significantly affected by cucumber biomass. However, numerically the tallest plant (96.0cm) was produced from the application of 5 t ha$^{-1}$ cucumber biomass and the shortest plant (93.40 cm) was found from no application of cucumber biomass (Table 4). Plant height is a genetic character hence it was not affected by cucumber biomass. Number of total tillers hill$^{-1}$ was significantly influenced by the cucumber biomass. The highest number of total tillers hill$^{-1}$ (13.07) was recorded from the application of 5 t ha$^{-1}$ of cucumber biomass and the lowest one (11.31) was recorded from control treatment (no cucumber biomass). The application of cucumber biomass at the rate of 2.5 t ha$^{-1}$ produced the second highest number of total tillershill$^{-1}$ (12.88).

**Table 4.** Effect of cucumber biomass on the yield and yield component of T. *aman* rice cv. BR11

| Cucumber biomass (t ha$^{-1}$) | Plant height (cm) | Total tillers hill$^{-1}$ | Effective tillers hill$^{-1}$ | Grains panicle$^{-1}$ | 1000-grain weight (g) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) | HI (%) |
|---|---|---|---|---|---|---|---|---|
| 0 | 102.31 | 11.31b* | 9.96b | 97.00 | 22.17 | 3.70c | 5.55b | 39.53c |
| 2.5 | 102.34 | 13.07a | 11.80a | 110.20 | 22.29 | 4.22b | 5.70b | 42.80b |
| 5.0 | 104.71 | 12.88a | 12.22a | 111.70 | 22.48 | 4.78a | 5.47a | 46.60a |
| CV (%) | 2.96 | 9.25 | 10.63 | 20.38 | 2.52 | 10.61 | 8.71 | 29 |
| Level of sig. | NS | 0.01 | 0.01 | NS | NS | 0.01 | NS | 0.01 |

*In a column figures having common letters (s) do not differ significantly

The variation in number of total tillers hill$^{-1}$ might be due to the incorporation of cucumber biomass which helped to decrease weed density and dry weight. Number of effective tillers hill$^{-1}$ varied significantly due to the application of different amounts of biomass of cucumber plant. The results shows that the highest number of effective tillers hill$^{-1}$ (12.22) was produced by the application of 5 t ha$^{-1}$ cucumber biomass and control treatment (no cucumber biomass) produced the lowest (9.96) number of effective tillers hill$^{-1}$. Grains panicle$^{-1}$ was not significantly varied due to incorporation of different amounts of biomass of cucumber plant in the field. Table 4 shows that cucumber biomass @ 5 t ha$^{-1}$ produced numerically the maximum number (111.70) of grains panicle$^{-1}$. Numerically the lowest number (97.00) of grains panicle$^{-1}$ was observed with no cucumber biomass application. It was due to the fact that more cucumber biomass supplied more photosynthetic assimilate during grain filling. Application of cucumber biomass shows no significant effect on weight of 1000 grain. Numerically, the heaviest 1000-grain (22.48 g) was obtained from the application of 5.0 t ha$^{-1}$cucumber biomass and the lowest one (22.17g) was obtained from control treatment. Grain yield varied significantly due to different amounts of cucumber biomass application. Application of 5 t ha$^{-1}$ cucumber biomass produced the highest grain yield (4.78 t ha$^{-1}$) which was not statistically similar (4.22 t ha$^{-1}$) to that of application of 2.5 t ha$^{-1}$ cucumber biomass application. The highest grain yield obtained in 5 t ha$^{-1}$ cucumber biomass was the consequences of highest number of effective tillers hill$^{-1}$, highest number of grain panicle$^{-1}$ and heaviest 1000-grain weight. On the other hand, control

treatment produced the lowest grain yield (3.07 t ha$^{-1}$). Application of biomass increases the yield significantly. There was significant variation among the straw yields in respect of cucumber biomass incorporation. It is evident that the highest straw yield (8.54 t ha$^{-1}$) was produced by the application of cucumber biomass of 5 t ha$^{-1}$ which was not statistically similar to cucumber biomass application at 2.5 t ha$^{-1}$ (6.57 t ha$^{-1}$). Control treatment produced the lowest straw yield (7.27 t ha$^{-1}$). Cucumber biomass exerted significant effect on harvest index. The highest harvest index (45.16%) was produced by applying of cucumber biomass of 5 t ha$^{-1}$. The lowest harvest index (41.53%) was produced by control treatment which was statistically identical to the application of cucumber biomass of 2.5 tha$^{-1}$.

**Table 5.** Effect of nitrogen level on the yield and yield components of T. *aman* rice cv. BR 11

| Nitrogen level (kg ha$^{-1}$) | Plant height (cm) | Total tillers hill$^{-1}$ | Effective tillers hill$^{-1}$ | Grains panicle | 1000-grain weight (g) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) | HI (%) |
|---|---|---|---|---|---|---|---|---|
| 0 (17.5) | 102.18 | 10.36 | 9.63b* | 104.70 | 21.95 | 3.69c | 5.11b | 41.49b |
| 50% (35.0) | 103.73 | 13.52 | 12.29a | 102.00 | 22.40 | 4.28b | 5.69a | 43.14ab |
| 100% of the RD (70.0) | 103.44 | 13.37 | 12.06a | 112.20 | 22.60 | 4.73a | 5.93a | 44.30a |
| CV (%) | 2.96 | 9.25 | 10.63 | 20.38 | 2.52 | 13.27 | 8.71 | 5.29 |
| Level of sig. | NS | NS | 0.01 | NS | NS | 0.01 | 0.01 | 0.05 |

In a column figures having common letters (s) do not differ significantly

**Table 6.** Interaction of cucumber biomass and nitrogen level on the yield and yield components of T. *aman* rice cv. BR 11

| Interaction of Cucumber biomass and N level | Plant height (cm) | Total tillers tillers hill$^{-1}$ | Effective tillers hill$^{-1}$ | Grains panicle$^{-1}$ | 1000-grain weight (g) | Grains yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) | HI (%) |
|---|---|---|---|---|---|---|---|---|
| $C_0N_1$ | 99.67 | 8.367d* | 7.23d | 96.90 | 21.82 | 3.07c | 5.13bc | 36.06d |
| $C_0N_2$ | 103.56 | 12.80abc | 12.07abc | 82.09 | 21.91 | 3.83bc | 5.70abc | 40.25d |
| $C_0N_3$ | 103.69 | 12.77abc | 10.57c | 112.00 | 22.78 | 4.18b | 5.83ab | 41.74bc |
| $C_1N_1$ | 101.78 | 12.00bc | 11.07bc | 107.36 | 21.93 | 3.83bc | 5.42abc | 41.30c |
| $C_1N_2$ | 103.31 | 12.93ab | 11.20bc | 107.23 | 22.57 | 4.48b | 6.00ab | 43.38abc |
| $C_1N_3$ | 101.93 | 14.27a | 13.13ab | 115.91 | 22.37 | 4.33b | 5.68abc | 43.70abc |
| $C_2N_1$ | 105.11 | 10.73c | 10.60c | 109.93 | 22.10 | 4.17b | 4.77c | 46.56a |
| $C_2N_2$ | 104.31 | 14.83a | 13.60a | 116.66 | 22.71 | 4.52b | 5.37abc | 45.78ab |
| $C_2N_3$ | 104.71 | 13.07ab | 12.48abc | 108.63 | 22.64 | 5.67a | 6.27a | 47.47a |
| CV (%) | 2.96 | 9.25 | 10.63 | 20.38 | 2.52 | 13.27 | 8.71 | 5.29 |
| Level of sig. | NS | 0.05 | 0.01 | NS | NS | 0.04 | 0.05 | 0.05 |

In a column figures having common letters (s) do not differ significantly, $C_0$ = No cucumber biomass (control), $C_1$ = 2.5t ha$^{-1}$, $C_2$ = 2.5t ha$^{-1}$, $N_1$ = 25% of the RD, $N_2$ = 50% of the RD, $N_3$ = 100% of RD, RD = Recommended dose

**Effect level of nitrogen:** The plant height was not significantly affected by nitrogen level. Results show that nitrogen level at 17.5 kg ha$^{-1}$ (25% of the recommended dose of N) produced numerically the tallest plant (96.07cm) and nitrogen level @ 70 kg ha$^{-1}$ (100% of the recommended dose of N) produced the shortest plant (93.40 cm) (Table 5). Production of total tillers hill$^{-1}$ was not significantly influenced by the level of nitrogen. Numerically the highest number of total tillers hill$^{-1}$ (13.52) was recorded in nitrogen levels @ 70kg ha$^{-1}$ (100% of the recommended dose) and the lowest number of total tillers hill$^{-1}$ (10.36) was observed in nitrogen level @ 17.5 kg ha$^{-1}$ (25% of the recommended dose of N). The application of nitrogen level @ 35kg ha$^{-1}$(50% of the recommended dose) had the second highest number of total tillers hill$^{-1}$ (13.37). Level of nitrogen had significantly effect on the number of effective tillers hill$^{-1}$. The result shows that the highest number of effective tillers hill$^{-1}$ (12.29) produced with application of N 35kg ha$^{-1}$ (50% of the recommended dose) and @ 17.5kg ha$^{-1}$ (25% of the recommended dose) produced the lowest (9.63) number of effective tillers hill$^{-1}$. Incorporation of nitrogen level supplies additional nutrients to rice plants which help to increase the number of effective tillers. Level of nitrogen had no significant effect on grain pancle$^{-1}$. Numerically the highest number of grain panicle$^{-1}$ (112.20) was recorded from the application of 70 kg N ha$^{-1}$ (100% of the recommended dose) and the lowest number (102.00) of grains panicle$^{-1}$ was observed with the application of @ 17.5kg ha$^{-1}$ (25% of the recommended dose). Nitrogen level had no significant effect on 1000 grain weight. The highest 1000 grain weight (22.60 g) was obtained from the application of @ 70kg N ha$^{-1}$ (100% of the recommended dose) and the lowest one (21.95g) was obtained from 17.5 kg ha$^{-1}$ (25% of the recommended dose). Grain yield was found to be significantly influenced due to different nitrogen levels. Nitrogen level @ 70 kg ha$^{-1}$ (100% of the recommended dose) produced the highest grain yield (4.73 t ha$^{-1}$) which was not statistically similar to the grain yield (4.28 t ha$^{-1}$) with application of @ 35 kg ha$^{-1}$ (50% of the recommended dose). On the other hand, application of 17.5 kg ha$^{-1}$ (25% of the recommended dose) of nitrogen produced the lowest grain yield (3.69 t ha$^{-1}$). Application of nitrogen increases the yield significantly. Similar research findings were also reported by Ahmed *et al.* (1998) and Hirzel *et al* (2011). Nitrogen level had significant effect on straw yield. The highest straw yield (6.59 t ha$^{-1}$) was produced by the application of @ 70 kg ha$^{-1}$ (100% of the recommended dose) (9.09 t ha$^{-1}$) which was statistically similar to nitrogen level of 35 kg ha$^{-1}$ (50% of the recommended dose) and 17.5 kg N ha$^{-1}$ (25% of the recommended dose) produced the lowest straw (6.43 t ha$^{-1}$). Numerically the highest harvest index (45.52%) was produced by the application of 70 kg N ha$^{-1}$

(100% of the recommended dose). The lowest harvest index (41.12%) was produced by the application of 17.5 kg $ha^{-1}$ (25% of the recommended dose) which was statistically identical to the application of 35kg N $ha^{-1}$ (50% of the recommended dose).

**Interaction effect of cucumber biomass and level of nitrogen:** The experimental result shows that the interaction effect of cucumber biomass and level of nitrogen had no significant effect on plant height. Numerically the tallest plant (96.27 cm) was obtained from the application of 5.0 t $ha^{-1}$ cucumber biomass × 70 kg N $ha^{-1}$ (100% of the recommended dose) and the shortest one (93.40 cm) with control treatment (no cucumber biomass) with 17.5 kg N $ha^{-1}$(25% of the recommended dose) (Table 6). The number of total tillers $hill^{-1}$ was significantly influenced by the interaction effect of cucumber biomass and level of nitrogen. The highest number of total tillers $hill^{-1}$ (14.83) was obtained from the application of 5.0 t $ha^{-1}$ cucumber biomass × 70 kg $ha^{-1}$ (100% of the recommended dose). The lowest number of total tillers $hill^{-1}$ (10.73) was recorded from control treatment (no cucumber biomass) at 17.5 kg $ha^{-1}$ (25% of the recommended dose). Interaction of cucumber biomass and level of nitrogen had significant effect on effective tillers $hill^{-1}$. The highest number of effective tillers $hill^{-1}$ (13.60) was recorded from the application of 5.0 t $ha^{-1}$ cucumber biomass × 70 kg $ha^{-1}$ (100% of the recommended dose) and the lowest one (7.23) was recorded in control treatment (no cucumber biomass) and 17.5 kg $ha^{-1}$ (25% of the recommended dose). The interaction effect of cucumber biomass and level of nitrogen on number of grains $panicle^{-1}$ was not significant. Numerically the highest number of grains $pancle^{-1}$ (116.66) was recorded from the application of 5.0 t $ha^{-1}$ cucumber biomass × 70 kg $ha^{-1}$ (100% of the recommended dose) and the lowest one (82.09) was observed control treatment (no cucumber biomass) × 17.5 kg $ha^{-1}$ (25% of the recommended dose). The interaction effect of cucumber biomass and level of nitrogen on weight of 1000-grain was not significant. Apparently the maximum weight of 1000-grain (22.78 g) was found from the application of 5.0 t $ha^{-1}$ (no cucumber biomass) × 70 kg $ha^{-1}$ (100% of the recommended dose) and the minimum weight of 1000-grain (21.82) was observed control treatment (no cucumber biomass) × 17.5 kg $ha^{-1}$ (25% of the recommended dose). The interaction of cucumber biomass and nitrogen level had significant effect on the yield of transplant *aman* rice. The highest grain yield (5.67 t $ha^{-1}$) was obtained from the application of 5.0 t $ha^{-1}$ cucumber biomass with 70 kg $ha^{-1}$ (100% of the recommended dose) followed by other treatments. The lowest grain yield (3.07 t $ha^{-1}$) was observed in control treatment (no cucumber biomass) with 17.5 kg $ha^{-1}$ (25% of the recommended dose). The interaction effect of cucumber biomass and nitrogen level was significant on straw yield. The highest straw yield (9.57 t $ha^{-1}$) was obtained from the application of 2.5 t $ha^{-1}$ cucumber biomass with 70 kg $ha^{-1}$ (100% of the recommended dose) and the lowest straw yield (5.57 t $ha^{-1}$) with that of control treatment (no cucumber biomass) and 17.5 kg $ha^{-1}$ (25% of the recommended dose). The interaction effect of cucumber biomass and nitrogen level was significant. The highest harvest index (46.67) was found from the application of 5 $tha^{-1}$ cucumber biomass with 70 kg $ha^{-1}$ (100% of the recommended dose) and the lowest one (42.22) with that of control treatment (no cucumber biomass) and 35 kg $ha^{-1}$ (50% of the recommended dose).

From the results of the study it may be concluded that green biomass @ 5 t $ha^{-1}$ with 70 kg N $ha^{-1}$ showed the best performance in reducing weed infestation and in producing higer yield of T. *aman* rice cv. BR11. Cucumber biomass @ 5 t $ha^{-1}$ with 70 kg N $ha^{-1}$ (100% of the recommended dose) showed the best performance in reducing weed density, weed dry weight and increased weed control efficiency. It also showed best performance with respect to most yield attributes e.g. total number of tillers $hill^{-1}$, grain yield, straw yield and harvest index of BR11. From the results of the present study it may be concluded that it may be concluded that incorporation of green biomass of cucumber @ 5 t $ha^{-1}$ with 70 kg N $ha^{-1}$ showed the best performance in weed suppression and yield of *T. aman* rice.

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