

## Yield Test of Hybrid Harapan Chili (*Capsicum annum* L.)

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### ABSTRACT

*The purpose of this study was to determine the yield test of the promising hybrid chili (Capsicum annum L.). The research was conducted at the experimental farm of IPB Leuwikopo, located in Darmaga District, Bogor Regency, West Java. The implementation of the research consisted of several stages, namely nursery, land management, planting, maintenance, harvesting, disease inoculation and observation. Observations were made on 10 sample plants, which were randomly selected for each replication. The hybrid chili genotypes tested showed the same results as the comparison varieties in qualitative characters, especially flower petal color, flower crown color, fruit shape, fruit mesocarp surface and old fruit color. As well as showing a higher yield than the comparison shown in the F-count test with a significant difference between the hybrid chilies tested and the comparison on the characters of dichotomous height, leaf length, weight per fruit, fruit length, fruit mesocarp thickness, weight of 1000 seeds, age of flowering, marketable harvest, fruit weight per plant and chili fruit production per hectare. The results of the genotype testing of hybrid chilies were superior to the comparison varieties for quantitative characters, in particular (dichotomous height, leaf length, weight of each fruit, fruit length, fruit mesocarp thickness, weight of 1000 seeds, age at start of flowering, market-worthy harvest, fruit weight per plant, and chili production per hectare).*

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## 1. INTRODUCTION

Chili pepper (*Capsicum annum* L.) is an important vegetable commodity having high economic value (Marianah, 2020). Chili belongs to the eggplant family (*Solanaceae*) of the *Capsicum* genus. Chili is a seasonal woody shrub with a height of up to one meter, the fruit is spicy and can grow well in a tropical climate (Zahroh et al., 2018). Efforts to increase chili production are needed to meet domestic consumption which continues to increase. National red chili production in 2020 was 1,264,190 tons with a productivity of 6.59 ton/

ha (BPS, 2020). This figure is still relatively low when compared to its production potential which can reach 12 tons per hectare. The low productivity is not only due to the lack of optimal cultivation technology but also due to high pest and disease attacks (Supriadi *et al.*, 2018).

The use of hybrid chili is one of the best alternatives to increase the national red chili production. Hybrid chili has superior characteristics, including its so fast growth that matures early, very responsive to high fertilization, better fruit quality and heavier fruit weight than local chili, production per plant and per acreage is much higher than those of local chilis with the same cultivation measures (Setiawan *et al.*, 2019).

Many farmers have used imported hybrid varieties. Although the production potential of imported hybrids is higher than the local varieties commonly used by farmers, the imported seeds have several negative aspects, namely higher prices, higher production inputs, creating dependence on imported seeds, and some varieties are vulnerable to biotic and abiotic stresses (Chesaria *et al.*, 2018). Domestic hybrid chili development needs to be executed so that the price of hybrid seeds is cheaper and the seeds can be adapted to the biotic and abiotic environment in Indonesia. The Division of Genetics and Plant Breeding, Department of Agronomy and Horticulture, Bogor Agricultural University (IPB) has started a hybrid chili development program since 2003. At present, several crosses have been obtained which reveal encouraging results in the preliminary test, which is known as a Harapan hybrid chili. Harapan hybrid chili is a chili genotype that is expected to be superior in the future, which includes superior in agronomic characters, superior in production characteristics, and resistance to certain pests and diseases.

One of the important diseases that often attack chili plants is anthracnose. This disease is caused by the fungus *Colletotrichum gloeosporioides*, *C. Capsici*, and *C. accutatum* Simm (Tanjung *et al.*, 2018). This hybrid is expected to be resistant to anthracnose disease so that it has the potential to be released as a commercial hybrid variety. Prior to the release of varieties, it is necessary to test the yield (productivity) of the developed hybrid chilies, which include yield tests and multi-site tests.

This study aims to test the productivity of chili seeds developed by IPB and compare it with the productivity of commercial chili seeds. Productivity test is a test of yield capability or production capability of the expected hybrid chili. While the multi-site test is a test of productivity at various research locations. This research is part of a multi-site test in the context of releasing varieties. One of the locations used in this research is the Leuwikopo Experimental Farm of IPB. The test involved five hybrids that have been released and used by farmers as a comparison.

## 2. MATERIALS AND METHODS

### 2.1. Location

This research was conducted at the end of November 2016 to the end of May 2017 at the Leuwikopo Experimental Farm, IPB located in Darmaga District, Bogor Regency, West Java (latitude: -6.56429991824; longitude: 106.724839211). The experimental farm has a height of 250 m above sea level, temperature between 22.08 °C and 34.01 °C, monthly precipitation of 26–611 mm, rainfall day of 8–29 days per month, humidity 72–87%, and the length of irradiation 61–94 days per year.

### 2.2. Materials

In this study, 11 hybrids of chili from the Faculty of Agricultural Genetics and

Horticulture and the Faculty of Plant Cultivation (IPB) were used as plant materials, including IPB-CH1, IPB-CH2, IPB-CH3, IPB-CH4, IPB-CH5, IPB-CH6, IPB-CH19, IPB-CH25, IPB-CH28, IPB-CH50, and IPB-CH51. In addition, five commercial hybrids were also tested for a comparison, including Hot Beauty, Gada, Adipati, Imperial, and Biola. Other materials were sterile seedling media, inoculum from pure culture of the fungus *C. accutatum* Simm (Isolate MJK 01, Isolate PYK 04, Isolate PSG 07, Isolate BGR 027), PDA (Potato Dextrose Agar), foliar fertilizer, manure, NPK Mutiara, and pesticides. The equipment needed is seedling trays, stakes, counter, scales, caliper, label paper, land tillage equipment, raffia plastic rope, syringe (size 22), blood cell calculator, Ohaus electric scale, and plastic caps.

### 2.3. Experimental Design

This research was arranged in a Randomized Block Design (RBD) which was carried out in 3 replication blocks with genotype (hybrid) as treatment. In this study, chili hybrids from 16 genotypes consisting of 11 IPB genotypes and 5 comparison genotypes as previously mentioned were used for a total of 48 test plot units. In each experimental plot, 20 plants were provided. The variables observed included dichotomous height, plant height, canopy area, leaf length, leaf width, weight per fruit, fruit length, fruit diameter, fruit mesocarp thickness, weight of 1000 chili seeds, age at start of flowering, marketable harvest, fruit weight per plant, and chili production per hectare. The obtained data was then analyzed for variance and continued with Dunnett's test at the 5% level if the analysis was significantly different (IPB genotype vs. comparison).

### 2.4. Experimental Steps

The implementation of the research included several steps of activities started from seeding, land preparation, planting, maintenance, harvesting, and inoculation of disease. This research began with the preparation of tools and equipment, including supporting planting and preparation of chili seeds, chemicals for plants, and land preparation at the planting site.

#### 2.4.1. Seedling and Land Preparation

Seedling were carried out in seedling trays in a sterile environment, resulting in healthy seedlings. Before sowing the seeds in the trays, the growing media were sterilized in a greenhouse at 150 °C for 3 hours. Chili seeds will germinate after the first week, and it is necessary to apply the recommended amount of NPK Mutiara fertilizer. The application of fertilizer must be done carefully so as not to touch the chili leaves. Plants in trays can be transferred to the field after 4 weeks of age or when shoots have appeared and have first leaves ([Prastio & Farmia, 2021](#)).

At the same time as seeding activities, land preparation was carried out. The land used in this study was land that has never been used to grow horticultural crops. Land preparation begun with loosening and leveling the soil. Rocks or lumps of soil and weeds should be removed. Planting plots were then made, and drainage ditches were provided to avoid waterlogging. The width of the plot is 1 m with a length of 5 m and a height of 20 cm. After that, the soil was given with basic fertilizer consisting of SP-36, KCL, Urea and chicken manure, which was mixed evenly with the soil and left for two weeks. Chili seedling were planted in two rows with a spacing of 50 cm by 50 cm.

#### 2.4.2. Planting and Maintenance

To avoid evaporation, transplanting of chili seeds was carried out in the afternoon. Transplanting was performed by inserting one chili seed in a planting hole that has pre-

viously been sprinkled with Furadan. Watering was carried out around the plants using water mixed with NPK Mutiara fertilizer, Curacron insecticide and Dithane-M45 fungicide. Watering should be done carefully and do not touch the leaves (Polii *et al.*, 2019). Watering the plants is done in the morning. Weeding is done once a week manually by pulling and cleaning using a small hoe. Pest and disease control was carried out if symptoms of insects or disease presented, but for prevention, pesticides were sprayed every week according to the recommended dose (Polii *et al.*, 2019).

#### 2.4.3. Harvesting and Inoculation

Chili can be harvested when the fruit has entered the maturity phase which is indicated by a 75% red color on the fruit. Fruit will be fully ripe in 55–60 days after flower bloom and harvesting can take several months under optimum conditions. In this study, harvesting measurement was only carried out for up to 10 weeks. The weight of the harvest is properly weighed and recorded at each harvest time.

Inoculation experiments were carried out in the laboratory. The fruit to be inoculated is the fruit from the harvest in the field as many as 80 pieces from the 16 genotypes. The fruit was green and had reached its maximum size. Inoculation was carried out using the injection method by injecting 2 µl of fungal inoculum in the form of conidia onto the surface of chili peppers with a concentration of  $5 \times 10^5 \text{ ml}^{-1}$ . For fruit with a size of 2–3 cm, it was done with one injection per fruit, while those with a size above 4 cm were done with two injections in different areas, namely one third of the base of the fruit and the tip of the fruit (Hidayat *et al.*, 2020).

### 3. RESULTS AND DISCUSSION

#### 3.1. General Description

During the study, pests that attacked chili plants were fruit flies (*Dacus dorsalis*), thrips (*Thrips parvisipimus*) which caused chili leaves to curl, and leaf curls caused by whiteflies. These pests attack chili plants from the beginning of grain formation and cause the fruit to rot, fall and cannot be consumed, so that it can reduce the production of chili plants. Control of pests and diseases of chili plants is carried out using pesticides and fruit fly traps methyl eugenol according to the recommended dose. The results of the tested hybrid chili genotypes were the similarities between the comparator varieties in qualitative characteristics (petal color, crown color, fruit shape, mesocarp surface and ripe fruit color).

#### 3.2. Quantitative Observation

##### 3.2.1. F-value, Probability and Variation Coefficient

Table 1 presents a recapitulation of F-value, probability and coefficient of variation of observed variables. The results of the analysis of variance (ANOVA) as given in Table 1 show that there is a significant positive difference in relation to the hybrid chili test as compared to the commercial varieties Gada, Hot Beauty, Imperial, Adipati, and Biola. The difference lies in the characters of dichotomous height, weight per fruit, leaf length, fruit mesocarp thickness, fruit length, age at start of flowering, weight of 1000 chili seeds, fruit weight per plant, marketable harvest, and chili production per hectare. Meanwhile, the characteristics of the canopy area, leaf width and plant height did not show a significant difference between the IPB genotypes tested as compared to the five commercial varieties of hybrids chili.

**Table 1.** F-value, probability and variation coefficient for observed parameters

No	Parameters	F-value	Probability	Coefficient of variation
1.	Dichotomus height	5,58**	0,0001	7,1342
2.	Plant height	1,77tn	0,0886	8,0510
3.	Canopy area	1,88tn	0,0690	9,8220
4.	Leaf length	5,43**	0,0001	7,6745
5.	Leaf width	1,93tn	0,0611	8,8812
6.	Mass per fruit	18,84**	0,0001	11,912
7.	Fruit length	14,09**	0,0001	8,0943
8.	Fruit diameter	13,8**	0,0001	7,1884
9.	Fruit mesocarp thickness	3,77*	0,0010	12,1378
10.	Mass of 1000 seeds	6,95**	0,0001	13,3891
11.	Age flowering	2,18*	0,0340	9,13781
12.	Panen Layak Pasar	2,56*	0,0139	47,2166
13.	Bobot Buah per Tanaman	4,56**	0,0002	22,3046
14.	Produksi per Hektar	4,56**	0,0002	22,3126

Note : \* = significantly different at a level of 5%; \*\* = very significantly different at a level of 1%; tn = not significantly different at a level of 5%

### 3.2.2. Dichotomus and Leaf Length

After the first harvest, the height of the dichotomus can be measured, the measurement starting from the main branch to the ground level. Using 10 plants, the average dichotomous height of the 11 genotypes of IPB hybrid chili tested ranged from 19.1–26.6 cm. Based on Table 2, the genotypes of hybrid chilies tested using dichotomous height observations showed that IPB-CH4 and IPB-CH25 were statistically different as compared to those of commercial genotypes Gada, Adipati, and Hot Beauty. Genotypes IPB-CH4 and IPB-CH25 have dichotomous height higher, namely 23.9 cm and 26.6 cm, over the comparisons of Gada, Adipati and Hot Beauty, but they are not different with Biola and Imperial. IPB-CH50 with a dichotomous height of 22.5 cm only shows the difference to Hot Beauty, but was not significantly different in dichotomous height against the other four comparators. The genotypes of IPB-CH3, IPB-CH5, IPB-CH6 and IPB-CH28 were only different significantly to the Biola comparator, while IPB-CH51 with the lowest dichotomous height (19.1 cm) was only significantly different to the Biola and Imperial comparator.

Measurement of leaf length used a sample of 10 leaves and leaf length was measured from the tip to the base of the leaf. In Table 2, the average leaf length of the IPB hybrid chilies tested was 6.6–9.0 cm. Compared with Gada, none of the tested hybrid chili genotypes showed significant differences in leaf length characteristics. However, the leaves of several IPB genotypes were longer than the leaves of the comparator genotypes. The IPB-CH2 genotype showed a significant difference against the Imperial and Hot Beauty, but did not show a significant difference against the Biola, Gada, and Adipati. The one with the longest leaves (9.0) was the IPB-CH3 genotype and clearly different to that of Hot Beauty, Biola and Imperial. IPB-CH5 (8.0 cm) and IPB-CH28 (8.1 cm) genotypes differed from Imperial, but did not differ from 4 other comparators. Meanwhile, the shortest leaf was showed by IPB-CH19, which only had a difference against the Adipati.

### 3.2.3. Weight per Fruit and Fruit Length

Based on data analysis, the average weight per fruit of the tested hybrid chili genotypes showed that there were variations of the significant differences and that most of the genotypes of hybrids chili showed an average weight per fruit the same or heavier than the weight per fruit of comparator varieties. Only IPB-CH2 (7.61 g), IPB-CH4 (4.53 g) and IPB-CH5 (5.69 g) had a lower weight per fruit than the other genotypes as well as comparator varieties. The low weight per fruit of the three genotypes could be caused by the smaller fruit size compared to the other hybrids tested and the five comparator varieties (Table 3).

The average weight per fruit of the 11 genotypes tested was 4.53–17.45 g. The IPB-CH2 genotype was significantly different from the Adipati comparison only, but did not differ from the Gada, Hot Beauty, Biola and Imperial comparators. IPB-CH3 genotype was not significant different to Gada, Adipati, Biola and Imperial, but showed a different weight per fruit with Hot Beauty. IPB-CH4 had the smallest weight per fruit (4.53 g) and showed significantly different results for the five comparator varieties. In addition to the IPB-CH4 genotype which showed differences in weight per fruit against all comparators, IPB-CH51 also showed significant differences in weight per fruit towards the five comparator varieties. IPB-CH51 had average weight of 17.45 g per fruit, heaviest among all tested genotypes and comparator varieties. The IPB-CH5 did not show a significant difference to Hot Beauty, but there was a significant difference to the other four comparators. The IPB-CH25 genotype only differed from the Hot Beauty. The IPB-CH28 genotype was only different significantly from the two comparators, namely Hot Beauty and Imperial, while the IPB CH50 genotype showed a significant difference to Hot Beauty, Biola and Imperial. Genotypes that showed no difference to the five comparators were IPB-CHI, IPB-CH6 and IPB-CH19.

**Table 2.** The average dichotomous height and leaf length of the tested hybrid chilies as compared with the commercial hybrids

Genotype	Dichotomus height (cm)	Leaf length (cm)
IPB-CH1	21,9	7,6
IPB-CH2	21,9	8,8 <sup>ce</sup>
IPB-CH3	20,7 <sup>d</sup>	9,0 <sup>cde</sup>
IPB-CH4	23,9 <sup>abc</sup>	7,1
IPB-CH5	20,7 <sup>d</sup>	8,0 <sup>e</sup>
IPB-CH6	21,1 <sup>d</sup>	6,9
IPB-CH19	21,4	6,6 <sup>d</sup>
IPB-CH25	26,6 <sup>abc</sup>	8,6 <sup>ce</sup>
IPB-CH28	20,6 <sup>d</sup>	8,1 <sup>e</sup>
IPB-CH50	22,5 <sup>c</sup>	8,4 <sup>ce</sup>
IPB-CH51	19,1 <sup>de</sup>	7,8
Gada	18,9	7,7
Adipati	18,9	8,3
Hot beauty	18,6	6,8
Biola	25,0	7,4
Imperial	22,9	6,4

Notes: Figures followed by the letter a, b, c, d, and e indicate a significant difference to respectively Gada, Adipati, Hot Beauty, Biola, and Imperial varieties at the 5% level of Dunnet's test

**Table 3.** Average weight per fruit and fruit length of hybrid chilies tested compared to comparator hybrids

Genotype	Mass per fruit (g)	Fruit length (cm)
IPB-CH1	9,5	13,5 <sup>d</sup>
IPB-CH2	7,6 <sup>b</sup>	12,3
IPB-CH3	11,9 <sup>c</sup>	14,0 <sup>d</sup>
IPB-CH4	4,5 <sup>abcde</sup>	7,6 <sup>abcde</sup>
IPB-CH5	5,7 <sup>abde</sup>	10,8 <sup>ae</sup>
IPB-CH6	10,5	13,2
IPB-CH19	9,9	11,2 <sup>ae</sup>
IPB-CH25	11,9 <sup>c</sup>	14,6 <sup>d</sup>
IPB-CH28	12,2 <sup>ce</sup>	15,0 <sup>cd</sup>
IPB-CH50	12,8 <sup>cde</sup>	14,5 <sup>d</sup>
IPB-CH51	17,5 <sup>abcde</sup>	17,7 <sup>abcde</sup>
Gada	10,2	14,3
Adipati	11,8	13,1
Hot beauty	8,1	12,1
Biola	9,4	10,8
Imperial	9,0	14,0

Notes: Figures followed by the letter a, b, c, d, and e indicate a significant difference to respectively Gada, Adipati, Hot Beauty, Biola, and Imperial varieties at the 5% level of Dunnet's test

There is a clear difference in the Biola variety to the genotypes of IPB-CH1, IPB-CH3, IPB-CH25 and IPB-CH50, based on the results of observations that have been made regarding the length of the hybrid chilies tested. Gada and Hot Beauty produce fruit that is longer than the Biola variety. The varieties of Adipati and Imperial as well as IPB-CH1, IPB-CH3, IPB-CH25 and IPB-CH50 genotypes were equally matched in fruit length. The fruit length of the 11 genotypes of hybrid chili had the average value of 7.6 – 17.7 cm. The genotypes of IPB CH5 and IPB CH19 had difference with Gada and Imperial, but did not have clear differences with Adipati, Hot Beauty and Biola. The IPB-CH28 genotype had a significant difference only with the comparators of Hot Beauty and Biola, but did not have a clear difference to the other three comparisons.

### 3.2.4. Fruit Diameter, Mesocarp Thickness and Mass of 1000 Seeds

The test results showed that the diameter of the IPB hybrid chilies was 0.87–1.40 cm. Based on Table 4, the IPB-CH4 and IPB-CH5 genotypes have smaller diameters, while the others have larger diameters as compared to thoses of comparator varieties. The smallest fruit diameter was presented by the IPB-CH4 genotype with 0.87 cm, but it was larger as compared to Gada and Adipati. The largest fruit diameter was indicated by the IPB-CH3 genotype with 1.40 cm. IPB-CH3 has a larger diameter against Gada, Hot Beauty, Biola and Imperial. IPB-CH1 has similarities to all comparators except the Biola. IPB-CH2 and IPB-CH5 have larger diameters only for comparison with Adipati. Genotypes IPB-CH6, IPB-CH19, IPB-CH25 and IPB-CH28 have larger diameters than those of Imperial, Biola and Hot Beauty, show similarities to the other two comparators. IPB-CH50 and IPB-CH51 have larger diameters compared to Gada, Hot Beauty, Biola and Imperial comparisons, but there is no difference with Adipati.

Chili that has thick mesocarp flesh usually has a more spicy taste. The results showed that the fruit mesocarp thickness of the IPB chili genotype had an average of

0.14–0.24 cm. IPB-CH4 found differences in the fruit mesocarp which was thicker than the Hot Beauty but no difference was found against the other four comparators. The thinnest fruit mesocarp was found in the IPB-CH5 genotype with 0.14 cm, but it was found to be thicker than the comparison varieties of Gada, Adipati and Imperial, and no clear difference was found against the other two comparators. The thickest fruit mesocarp was demonstrated by the IPB-CH25 genotype. Furthermore, IPB-CH25 has a fruit mesocarp thickness of 0.24 cm which is thicker than the comparator varieties, especially Hot Beauty genotype.

**Tabel 4.** Average of fruit diameter, mesocarp thickness and mass of 1000 hybrid chili seeds.

Genotype	Fruit diameter (cm)	Mesocarp thickness (cm)	Mass of 1000 seed (gram)
IPB-CH1	1,13 <sup>d</sup>	0,20	0,71
IPB-CH2	1,03 <sup>d</sup>	0,20	0,51 <sup>ae</sup>
IPB-CH3	1,4 <sup>acde</sup>	0,20	0,59 <sup>ae</sup>
IPB-CH4	0,87 <sup>ab</sup>	0,15 <sup>e</sup>	0,44 <sup>ae</sup>
IPB-CH5	0,87 <sup>b</sup>	0,14 <sup>abe</sup>	0,41 <sup>ae</sup>
IPB-CH6	1,27 <sup>cde</sup>	0,22	0,55 <sup>ae</sup>
IPB-CH19	1,26 <sup>cde</sup>	0,22	0,74
IPB-CH25	1,26 <sup>cde</sup>	0,24 <sup>c</sup>	0,62 <sup>a</sup>
IPB-CH28	1,25 <sup>cde</sup>	0,20	0,82 <sup>b</sup>
IPB-CH50	1,31 <sup>acde</sup>	0,21	0,66
IPB-CH51	1,36 <sup>acde</sup>	0,23 <sup>c</sup>	0,64 <sup>a</sup>
Gada	1,08	0,20	0,86
Adipati	1,25	0,21	0,59
Hot beauty	1,04	0,17	0,62
Biola	0,87	0,18	0,61
Imperial	1,03	0,22	0,82

Notes: Figures followed by the letter a, b, c, d, and e indicate a significant difference to respectively Gada, Adipati, Hot Beauty, Biola, and Imperial varieties at the 5% level of Dunnet's test

From 1000 hybrid chili seeds, an average weight of 0.41–0.82 g can be obtained from IPB genotypes. Based on Table 4, most of the tested hybrid chili genotypes had a significant difference in weight of 1000 seeds against the comparator varieties Gada and Imperial, while Hot Beauty and Biola genotypes had no clear difference. There is a difference with one genotype comparator (Adipati), namely IPB-CH28 which has the largest weight of 0.82 g per 1000 seeds. The lowest weight of 1000 seeds was owned by the IPB-CH5 genotype with 0.41 g and had a greater difference as compared to Imperial and Gada. Genotypes IPB-CH1, IPB-CH2, IPB-CH3, IPB-CH4 and IPB-CH6 had a greater difference in weight only against Gada and Imperial, while IPB-CH25 and IPB-CH51 had a greater difference in weight only against comparator Gada.

### 3.2.5. Flowering Age and Fruit Weight per Plant

Observations on the age of flowering were carried out using 50% of the plant population in the plots replication for each of tested genotype. The age of flowering for all chili genotypes was in the range of 22.67–26 DAT (day after transplanting). The plant that had the fastest flowering age at 22.67 DAP was the IPB-CH19 genotype.



The fruit weight of each plant was calculated from the average fruit weight of all plant samples for each genotype. Table 5 shows that some of the genotypes had a greater difference in fruit weight per plant as compared to the comparators. The genotypes of IPB-CH1, IPB-CH28 and IPB-CH51 had a greater difference in fruit weight per plant compared to that of Hot Beauty. IPB-CH4 was significantly inferior as compared to Gada in term of fruit weight per plant (152.35 g vs. 297.69 g) and flowering age (26 d vs. 19 d). However, IPB-CH4 has an advantage, namely high capsaicin levels compared to other genotypes or comparator varieties. The results of Madhumita's research (2007) large capsaicin content with 610.83 ppm found in the IPB genotype. While the largest weight of fruit per plant was owned by IPB-CH3 with 418.41 g.

**Tabel 5.** Average age at start of flowering and fruit weight per plant of chili hybrids tested compared to comparison hybrids

Genotype	Age of flowering (DAT)	Fruit weight per plant (g)
IPB-CH1	25,33 <sup>a</sup>	301,59 <sup>c</sup>
IPB-CH2	24,00	190,31
IPB-CH3	24,33	418,41 <sup>bcd</sup>
IPB-CH4	26,00 <sup>a</sup>	152,35 <sup>a</sup>
IPB-CH5	25,67 <sup>a</sup>	249,91
IPB-CH6	24,00	254,62
IPB-CH19	22,67	209,45
IPB-CH25	24,33	253,64
IPB-CH28	24,67 <sup>a</sup>	276,03 <sup>c</sup>
IPB-CH50	25,00 <sup>a</sup>	264,39
IPB-CH51	23,33	290,63 <sup>c</sup>
Gada	19,00	297,69
Adipati	24,00	260,67
Hot beauty	25,33	135,72
Biola	22,67	187,88
Imperial	20,67	208,59

Notes: Figures followed by the letter a, b, c, d, and e indicate a significant difference to respectively Gada, Adipati, Hot Beauty, Biola, and Imperial varieties at the 5% level of Dunnet's test

### 3.2.6. Marketable Harvest

In general, all genotypes did not show significant differences in the results against the comparators, except for IPB-CH6 and IPB-CH25. From Table 6 it can be seen that the weight of marketable fruit was in average of 57.17–150.88 g/plant. The genotype with the lowest average market-worthy harvest was 57.17 g per plant, but did not show significant differences between the five comparator varieties. Meanwhile, the IPB-CH25 genotype had a larger market-worthy fruit weight difference compared to the Biola comparator. IPB-CH6 is the genotype having the largest marketable harvesting yield, namely 150.88 g, and shows a difference in weight for marketable fruit which is greater than the comparator varieties (Hot Beauty, Biola and Imperial).

**Tabel 6.** Average marketable harvest of hybrid chilies

Genotipe	Marketable Harvest (g/plant)	Comparison to the comparator varieties (%)				
		Gada	Adipati	Hot beatuy	Biola	Imperial
			141,36		680,02	
IPB-CH1	116,28	193,01	69,50	516,13	334,35	259,10
IPB-CH2	57,17	95,88	132,87	253,77	639,16	127,39
IPB-CH3	109,30	183,29	117,62	485,11	565,80	243,53
IPB-CH4	96,75	162,25	136,19	429,43	655,15	215,58
IPB-CH5	112,03	187,88	183,41	497,25	882,32	249,62
IPB-CH6	150,88	253,02	127,95	669,67*	*	336,18*
IPB-CH19	105,25	176,51	146,20	467,16	615,50	234,52
IPB-CH25	120,26	201,68	135,58	533,79	703,30	267,97
IPB-CH28	111,53	187,03	131,20	495,01	*	248,50
IPB-CH50	107,93	180,99	86,44	479,04	652,20	240,48
IPB-CH51	71,10	119,24		315,59	631,15	158,43
					415,80	
Gada	59,63					
Adipati	82,26					
Hot beauty	22,53					
Biola	17,10					
Imperial	44,88					

Note: Numbers followed by asteric sign (\*) mean that they are significantly different from the comparator varieties based on Dunnett's test at 5% level.

### 3.2.7. Chili Production per Hectare

The productivity of the hybrid chilies tested varied between 4.27–11.72 tons/ha (Table 7). The genotype with the lowest production was IPB-CH4 with 4.27 tons/ha, and was statistically different to Gada. Meanwhile, the highest production was obtained by the IPB-CH3 genotype with 11.72 tons/ha and had a significant difference to the Adipati, Hot Beauty, Biola and Imperial comparators.

### 3.2.8. Resistance Against Anthracnose

In the test of resistance to anthracnose, 11 genotypes were tested with comparator varieties using 4 anthracnose isolates, namely PSG isolate 07, PYK isolate 04, BGR isolate 027 and MJK isolate 01. There was variation in the anthracnose resistance class to PSG 07 isolate of the IPB chili genotypes tested, namely very susceptible, susceptible, resistant and very resistant, while the comparator varieties were very susceptible, susceptible and moderate. In Table 8, it can be seen that with PSG 07 isolate, IPB-CH6 and IPB-CH19 have superior resistance classes as compared to their comparators. IPB-CH6 genotype was resistant to anthracnose, while IPB-CH19 was highly resistant to anthracnose. One of comparator varieties (Gada) was moderate to anthracnose disease. The average resistance class of the tested chili genotypes against anthracnose PYK 04 isolate was relatively the same as compared to the comparator varieties. The IPB-CH4 was moderate to anthracnose disease, and this indicated that this genotype was superior over the five comparator varieties (Table 8).

**Tabel 7.** Average production per hectare of hybrid chilies tested compared to comparison hybrids

Genotype	Production (ton/ha)
IPB-CH1	8,44 <sup>c</sup>
IPB-CH2	5,33
IPB-CH3	11,72 <sup>bcde</sup>
IPB-CH4	4,27 <sup>a</sup>
IPB-CH5	7,00
IPB-CH6	7,13
IPB-CH19	5,86
IPB-CH25	7,10
IPB-CH28	7,73 <sup>c</sup>
IPB-CH50	7,40
IPB-CH51	8,16 <sup>c</sup>
Gada	8,34
Adipati	7,30
Hot beauty	3,80
Biola	5,26
Imperial	5,84

Notes: Figures followed by the letter a, b, c, d, and e indicate a significant difference to respectively Gada, Adipati, Hot Beauty, Biola, and Imperial varieties at the 5% level of Dunnet's test

**Table 8.** Resistance class of chili genotype towards anthracnose

Genotype	Resistance class to anthracnose			
	Isolate PSG 07	Isolate PYK 04	Isolate BGR 027	Isolate MJK 01
IPB-CH1	Very susceptible	Susceptible	Very susceptible	Very susceptible
IPB-CH2	Susceptible	Susceptible	Very susceptible	Susceptible
IPB-CH3	Susceptible	Susceptible	Very susceptible	Susceptible
IPB-CH4	Susceptible	Moderate	Susceptible	Moderate
IPB-CH5	Very susceptible	Susceptible	Very susceptible	Susceptible
IPB-CH6	Resistant	Very susceptible	Very susceptible	Susceptible
IPB-CH19	Very Resistant	Susceptible	Very susceptible	Susceptible
IPB-CH25	Susceptible	Susceptible	Very susceptible	Very susceptible
IPB-CH28	Very susceptible	Very susceptible	Very susceptible	Susceptible
IPB-CH50	Susceptible	Very susceptible	Very susceptible	Susceptible
IPB-CH51	Very susceptible	Very susceptible	Very susceptible	Susceptible
Gada	Moderate	Susceptible	Very susceptible	Susceptible
Adipati	Susceptible	Very susceptible	Very susceptible	Susceptible
Hot beauty	Very Resistant	Very susceptible	Very susceptible	Susceptible
Biola	Susceptible	Susceptible	Very susceptible	Susceptible
Imperial	Very susceptible	Susceptible	Very susceptible	Susceptible

The anthracnose resistance class on BGR 07 isolate showed that almost all of the tested genotypes and their comparators were highly susceptible to anthracnose disease except IPB-CH4. This genotype had better resistance to anthracnose compared to the five comparators. The class of anthracnose resistance in the MJK 01 isolate, which is presented in Table 8, shows that almost all of the tested genotypes are susceptible to anthracnose and there is no difference between the five comparators, except for IPB-CHI, IPB-CH4 and IPB-CH25. The IPB-CH4 genotype was moderate to anthracnose disease and was the only genotype that had yield advantages compared to the five varieties of comparators.

#### 4. CONCLUSION

The results of the genotype testing of hybrid chilies were superior to the comparator varieties for quantitative characters, in particular included dichotomous height, leaf length, weight of each fruit, fruit length, fruit mesocarp thickness, weight of 1000 seeds, age at start of flowering, market-worthy harvest, fruit weight per plant, and chili production per hectare. The advantages in the form of weight per fruit and fruit length were possessed by the IPB-CH51 genotype. While the superiority of the character of the total fruit weight per plant and fruit production per hectare was owned by the IPB-CH3 genotype. The overall fruit weight of IPB genotypes were lower than those of comparators, but there were advantages possessed by IPB-CH4 having high capsaicin levels compared to other genotypes or comparator varieties. In addition IPB-CH4 was moderate against anthracnose disease in PYK 04 isolates and MJK 01 isolates. IPB-CH6 genotype was attacked by anthracnose disease of PSG 07 isolate. Meanwhile, the superiority of flowering age and resistance to anthrax was demonstrated by IPB-CH19 genotype on PSG 07 isolate.

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