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Performance Evaluation of Coffee *Coffea canephora* (syn. *Coffea robusta*) Germplasm in the Hilly Region

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Abstract: The study was conducted at the Hill Agricultural Research Station, BARI, Khagrachari during the year 2017 to 2019. Thirty (30) genotype of *Coffea canephora* (syn. *Coffea robusta*) commonly known as robusta coffee from the existing coffee orchard of HARS, Khagrachari was selected for the study. The average height of evaluated line (CC Kha 001) was medium (4.31 m) and regular bearing shrub of small tree. The average width and length of leaf was 9.2 cm & 20.86 cm respectively with 1.6 cm of leaf petiole length. The average width and length of individual fruit was 1.28 cm & 1.16 cm respectively with 1.06 cm of thickness. Harvesting duration of fruit berry was mid-January to mid-February. The seed colour of evaluated coffee plant (CC Kha 001) was greenish brown with roundish shape. The average length and width of individual seed was 1.09 cm & 0.99 cm respectively with 0.75 cm of thickness. Average weight of 100 been was 100.33 gm. Average berry weight (kg) per trunk was 8.08 (kg/tree).
Keywords: Hill Agricultural Research Station, syn. *Coffea robusta,* agricultural commodity.

INTRODUCTION

Coffee is the world's most valuable and second most traded agricultural commodity after oil in international trade (ICO, 2007; Alemseged and Yeabsira, 2014). Today, coffee is one of the most important non-alcoholic beverage crops grown in over 80 countries and exported in different forms to more than 165 nations of the world (Dessalegn *et al*., 2008). It is used as a source of income to several developing countries in Africa, Asia and Latin America (Alemseged and Yeabsira, 2014). Among the 103 diverse species of genus *Coffea* (Davis *et al*., 2006), only two species namely Arabica (*Coffea arabica* L.) and robusta (*Coffea canephora* Pierre) are under commercial cultivation (Anthony *et al*., 2002; Pearl *et al*., 2004). According to AEC-FNCCI (2006) world coffee production grew at an annual rate of 3.6% in the last 10 years, but the demand had increased only by 1.3%, suggesting that there is a competitive state in coffee marketing.

Robusta is a species of flowering plant in the family Rubiaceae. Though widely known by the synonym *Coffea robusta*, the plant is currently scientifically identified as *Coffea canephora*. The plant has a shallow root system and grows as a robust tree or shrub to about 10 m tall. It flowers irregularly, taking about 10–11 months for cherries to ripen, producing oval-shaped beans. The robusta plant has a greater crop yield than that of arabica, contains more caffeine (2.7% compared to arabica's 1.5%), *(Mark Nesbitt (2005).* and contains less sugar (3–7% compared to arabica's 6–9%) (*The Coffee Barrister. 31 July 2016).* It is easy to care for, has a greater crop yield, has almost double the amount of caffeine and more antioxidants (Vignoli *et al*., 2011) and is less susceptible to disease than arabica coffea (*Penarredonda, Jose Luis (6 November 2017).* So is cheaper to produce. It is mostly grown in Vietnam, where French colonists introduced it in the late 19th century, though it is also grown in India, Africa and Brazil, where it is often called *conilon (A. Rami Horowitz, 2004).* Roasted robusta beans produce a strong, full-bodied coffee with a distinctive earthy flavour, but usually with more bitterness than arabica due to its pyrazine content *(Wintgens, Jean Nicolas (2009).* Good-quality robusta beans are used in traditional Italian espresso blends, at about 10–15%, to

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provide a full-bodied taste and a better foam head (known as *crema*). It is besides used as a stimulant, diuretic, antioxidant, antipyretic and relieves spasmodic asthma (*Robertson, Carol (2010).*

There is an ample scope of coffee cultivation in the hilly area of Bangladesh. The soil and environment of hill district is suitable for coffee plantation and farmer is highly interested for coffee plantation. In Chattogram Hill Tracts, Coffee has been producing since last two three decades particularly in the district of Bandarban coffee cultivation is practiced larger in compare to other two hill Districts. According to DAE (2019) in Bandaban districts coffee cultivation area is approximately 200 hectare and production was 1.5 t/ha. Hence, the study was undertaken to evaluate the performance of *Coffea canephora* (syn. *Coffea robusta*) germplasm in the hilly region.

MATERIALS AND METHODS

The experiment was laid out during the years 2017 to 2019 on trees grown at Hill Agricultural Research Station, BARI, Khagrachari to evaluate the performance evaluation of *Coffea canephora* (syn. *Coffea robusta*) germplasm in the hilly region. 30 (thirty) genotype of *Coffea canephora* (syn. *Coffea robusta*), commonly known as robusta coffee from the existing coffee orchard of HARS, Khagrachari was selected for the study. The manures and fertilizers were applied at the rate of Cow dung 15kg, Urea 500g, TSP 400g and MOP 450g per plant. Fertilizers are to be applied in two equal installments. First half: April-May (Before monsoon) and rest half: September- October (After monsoon). Fertilizers are applied in pegging method at hill. Irrigation was given during dry season. The flowering of coffee tree is mainly occurred during Jan-Feb right after picking of coffee cherries and especially after the massive irrigation in all over coffee plantation. This forced irrigation to help coffee trees recovered from the major harvesting which has destroyed the health of coffee tree. The tree produces coffee cherries 6-9 months after flowering. The cherries ripen at different rates in the same field and even in the same tree. Fully mature fruits were harvested from the plant and data on different parameters were recorded after ripening of the fruits and the mean data have been presented in the Table. Fruits were harvested from January-February. Data on plant growth characteristics, yield attributes and yield, quantitative fruit characters, qualitative fruit characters and disease-pest reaction were recorded. For fruit characters, ten fruits/plant were collected randomly and observation were recorded on each fruit separately fruit diameter, fruit length, albedo thickness, fruit rind thickness, fruit axis diameter, seed length and seed width were recorded using Digital Vernier Calipers. Seeds from fruits in each replication were collected by cleaning and washing. Seed number/fruit was counted manually for each fruit. Seed weight was recorded on the basis of average of 10 seeds per replication. Three years pooled data were used to evaluate the germplasm. Characterization has been done following to the descriptor published by IPGRI.

RESULT AND DISCUSSION

Three years average pooled data on growth, yield, yield components, fruit characteristics and disease and pest reaction of *Coffea canephora* (CC Kha 001) at HARS, Khagrachari during 2017, 2018 & 2019 are given in Table 1-4.

Morphological characteristics of coffee germplasm:
The average height of evaluated line (CC Kha 001) was medium (4.31 m) and regular bearing shrub of small tree. Overall appearance of plant is elongated conical and sympodial vegetable development. The shrub of small coffee tree is horizontal or spreading branching habit.

Table 1: Morphological characteristics (2017, 2018 & 2019)

Year	Plant habit	Plant height (m)	Overall appearance	Vegetable development	Branching habit
2017	Shrub of small tree	3.97	Elongated conical	Sympodial	Horizontal or spreading
2018	Shrub of small tree	4.25	Elongated conical	Sympodial	Horizontal or spreading
2019	Shrub of small tree	4.70	Elongated conical	Sympodial	Horizontal or spreading
Ave		**4.31**			

Leaf characteristics of coffee germplasm:
The young leaf colour of evaluated coffee plant (CC Kha 001) was green. Shape of leaf is lanceolate with apiculate appearance in the apex. The average width and length of leaf was 9.2 cm & 20.86 cm respectively with 1.6 cm of leaf petiole length. Colour of both leaf petiole and young shoot was green.

Table 2: Leaf characteristics (2017, 2018 & 2019)

Year	Young leaf colour	Leaf shape	Leaf apex shape	Leaf width (cm)	Leaf petiole length (cm)	Leaf petiole colour	Young shoot colour	Leaf length
2017	Green	lanceolate	Apiculate	8.72	1.16	Green	Green	18.3
2018	Green	lanceolate	Apiculate	8.52	1.18	Green	Green	22.64
2019	Green	lanceolate	Apiculate	10.36	1.14	Green	Green	21.65
Ave.				**9.2**	**1.16**			**20.86**

Fruit characteristics of coffee germplasm:

The fruit colour of evaluated coffee plant (CC Kha 001) was red purple and shape was roundish. The average width and length of individual fruit was 1.28 cm & 1.16 cm respectively with 1.06 cm of thickness. Harvesting duration of fruit berry was mid-January to mid-February.

Table 3: Fruit characteristics (2017, 2018 & 2019)

Year	Fruit colour	Fruit shape	Fruit length (cm)	Fruit width (cm)	Fruit thickness (cm)	Harvest duration (d)	Pulp thickness
2017	Red purple	Roundish	1.1	1.04	1.03	14.01.16-08.02.16	Thick
2018	Red purple	Roundish	1.45	1.28	1.09	17.01.17-03.02.17	Thick
2019	Red purple	Roundish	1.28	1.15	1.05	23.01.18-18.02.18	Thick
Ave.			**1.28**	**1.16**	**1.06**	**14.01-18.02**	

Seed and yield contributing characteristics of coffee germplasm:

The seed colour of evaluated coffee plant (CC Kha 001) was greenish brown with roundish shape. The average length and width of individual seed was 1.09 cm & 0.99 cm respectively with 0.75 cm of thickness. In line with the finding by Mekonen (2009) indicated that, selective harvested coffee of different varieties showed significant variation in bean size by recording highest percentage of beans retained above screen. Average weight of 100 been was 100.33 gm. Average berry weight (kg) per trunk was 8.08 (kg/tree). Similar result was reported by (Mohammedsani *et al*., (2017).

Table 4: Seed characteristics (2017, 2018 & 2019)

Year	Seed length (cm)	Seed width (cm)	Seed thickness (cm)	Seed colour	Seed shape	Berry weight / tree (kg)	100 been weight (gm)
2017	0.99	0.86	0.68	Greenish brown	Roundish	7.22	109
2018	1.22	1.12	0.81	Greenish brown	Roundish	8.70	94
2019	1.05	0.99	0.76	Greenish brown	Roundish	8.33	98
Ave.	**1.09**	**0.99**	**0.75**			**8.08**	**100.33**

CONCLUSION

From the performance evaluation of genotypes in the hilly areas of khagrachari it was seen that fluctuation of yield of robusta coffee over seasons was higher at less favorable than favorable environments. However, such fluctuation of yield can be minimized by applying agronomic practices such as adequate fertilization, mulching or growing coffee orchards in optimum shade levels. An overall improvement strategy of coffee (*Coffea canephora (syn. Coffea robusta) commonly known as robusta coffee*) was taken up by considering the above-mentioned justification. Thirty superior genotypes were selected for environmental adaptation and cultural practices. The present finding shows the great genetic potential of the studied germplasm. It can be used in future research programmes for getting productive and quality traits. Moreover, the variability observed in the current study could be used in coffee improvement programme. Finally, the researcher can choose germplasm according to their needs. Therefore, these coffee germplasms can be included in the variety development programme.

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