Progressive Agriculture 27 (2): 94-100, 2016 ISSN: 1017 - 8139

Progressive Agriculture
Journal homepage:http://www.banglajol.info/index.php/PA

Growth and yield difference due to application of various levels of gibberelic acid in local and BARI falon-1

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Abstract

An experiment was carried out at the research farm of Patuakhali Science and Technology University (PSTU) during the period from November 2010 to April 2011 to study on growth and yield performance of cowpea (BARI Falon-1 and local Falon) with different concentration of GA_3 (control, 25.00, 33.33, 50.00 and 100.00 ppm) to find out the suitable variety and optimum level of gibberelic acid (GA_3) application which would be also suitable to cultivate under coastal region of Patuakhali. Among the treatments, GA_3 at 33.33 ppm treated plant of BARI Falon–1 showed the better performance on growth and yield contributing characters. As a result, the tallest plant (62.53 cm), number of leaves and branches plant^{-1} (28.67 and 20.07, respectively), TDM (83.99 g), CGR (1.68 cm^2 day^{-1}), RGR (0.729 cm^2 day^{-1}) and NAR (1.275 cm^2 day^{-1}) were exhibited from the variety BARI Falon-1 with the spraying of GA_3 at 33.33 ppm at harvest. Yield contributing characters had also higher such as pods plant^{-1} (11.67), length of pod (17.20 cm), seeds pod^{-1} (16.80), 100-seed weight (12.49 g), seed yield (20.16 g plant^{-1} and 3139.93 kg ha^{-1}) and harvest index (24.04%) with the variety BARI Falon–1 whily it was treated by 33.33 ppm GA_3. Hence, it can be concluded that the application of GA_3 up to 33.33 ppm than other GA_3 levels and BARI Falon-1 than Local Falon would be the most suitable for obtaining the greater yield of cowpea under the coastal area of Patuakhali region. So, considering the above observation, BARI Falon-1 therefore is suggested to cultivate in Patuakhali region while 33.33 ppm GA_3 would be also optimum level for the better prodcution of cowpea.

Key words: Growth, yield difference, gibberelic acid, BARI falon-1

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Introduction

Cowpea (*Vigna unguiculata* L, Walp.) is locally known as Falon which was grown as a grain legume crop in *rabi* season and fodder in *kharif* season in the tropics and sub-tropics covering Asia, Africa, Southern Europe, Southern United States and Central and South America (Ullah *et al*., 1995). Cowpea is probably of American origin from the fact that the plant was an important source of hay for cows in the United States and first found in literature in 1978. It was also called as “pease” and later “corn field pease”, because of planting it between the rows of field corn. It is now called as “Southernpeas”, “Blackeyed peas”, “Field peas”, “Pinkeyes”, and “Crowders” etc. Cowpea is a hardy crop well adapted to relatively dry environments. In Bangladesh, the area under cowpea production is about 16 thousand hectares where the yield is 632 Kg ha^{-1} and the production quantity 6000 tons (BBS, 2010). Cowpea fodder is an excellent source of essential nutrients with an average digestibility co-efficient of 74.35 % of the whole plant, 78.06 % of crude protein, 72.42 of crude fiber, 76.98 % of nitrogen free extract (soluble carbohydrate) and 71.81 % of ether extract. The green pod of cowpea contains 51.40 % water, 22.5 % protein, 10.1 % crude fiber, 56.29 %

soluble carbohydrate, 2.10 % fat and 9.0 % minerals (Rahman *et al*., 1992). In Bangladesh, the number of livestock is decreasing due to the lack of green grasses in grazing fields. Recently the dairy farms surrounding the urban areas have increased due to the growing need of milk and milk products for the urban people. So to sustain the dairy industries it is essential to increase fodder production where cowpea could be a potential crop. The poor yield is attributed to unavailability of high yielding and stable genotypes along with appropriate advance agronomic practices. However, growth regulators especially auxins have been reported to enhance the vegetative growth of many crops including legumes (Roy *et al*., 1990). Application of growth regulators like auxin has been reported to enhance the vegetative growth of legumes (Roy *et al*., 1990; Jain *et al*., 1995; Singh and Sharma, 1996; Rao and Narayanan, 1998). For normal growth and development, gibberellic acid (GA_3) is a phytohormone that is needed in small quantities at low concentration to accelerate plant growth and development. GA_3 enhances growth activities to plant, stimulates stem elongation and increases dry weight and yield (Deotale *et al.,* 1998). The challenge is to find ways of improving cowpea productivity, where varietal improvement modified cropping systems and use of plant growth regulators (PGRs) any improve cowpea yield (Emongor, 2007). Moreover growth regulators are used in appropriate concentrations, these substances influence the plant architecture in a typical fashion and improve the yield potential. Therefore, the current research work undertaken to evaluate the effect of various concentrations of GA_3 on growth and yield of Cowpea and to find out the most appropriate doses of GA_3.

Materials and Methods

A field experiment was conducted at the research farm of Patuakhali Science and Technology University (PSTU), Patuakhali during the period from November 2010 to April 2011. Geographically, the research farm is located at $22^0 37'$ N latitude and $89^0 10'$ E longitudes. The area is named as Gangetic Tidal Floodplains and falls under Agroecological Zone "AEZ- 13". The area lies at 1.5 meter above mean sea level. The soil of the experimental field was silty caly loam having pH value of 7.00. The OM content found 1.53% in most cases. Deficiency of nitrogen is acute and widespread. Status of exchangeable potasium is almost satisfactory. Phosphorus, sulphur and other characterstics of soil status are also optimum for its cultivation. Climatic conditions are also favourable for its cultivation. Two varieties of cowpea such as BARI Falon–1 and Local Falon as planting materials and five different levels of Gibberelic Acid (GA_3) including control (without GA_3) as treatment *viz.* T_0 = Control (without GA_3), T_1 = 25 ppm, T_2 = 33.33 ppm (recommended dose by Yon Longping high-tech. Agriculture Company Ltd.), T_3 = 50 ppm and T_4 = 100 ppm were used for the present study. A 100 ppm solution of GA_3 was prepared by dissolving 100 mg of GA_3 in 1 L of distilled water. The distilled water was added to make the volume 1 liter to get 100 ppm solution which was used as treatment T_4. Similarly another volume (T_1, T_2 and T_3) of GA_3 was prepared. Two factors experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The size of each unit plot was 2.0 m × 2.0 m where line to line and seed to seed distances were 30 and 15 cm, respectively, in each plot. The land of the experimental site was first opened on December 20, 2010 with a tractor and then the land was ploughed and cross-ploughed to obtain good tilth. All the weeds and stubbles were removed from the experimental field. The soil was treated with insecticides at the time of final ploughing. Insecticides Furadan 5G was used @ 8 kg ha^{-1} to protect young plants from the attack of mole cricket, ants, and cutworms. Fertilizers such as urea @ 8 kg, TSP @ 6 g and MoP 20 g were applied for each plot during final plot preparation. The seeds of Falon (cowpea) were sown in the research field on January 3, 2011. The distances between row to row and seed to seeds were 40 and 15 cm, respectively. Matured and viable 2 seeds were placed in each hole at 2-3 cm depth from the soil surface. Thinning out, gap filling, weeding, irrigation and disease and pest management operation were also done as intercultural operation for maximizing the yield. Continuous monitoring of growing seedlings and GA_3 spraying was also done as per treatment. The first crop sampling was done on 30 days after sowing (DAS) and it was continued up to physiological maturity on 90 DAS at an interval of 30 days. Harvesting of the cowpea was done after 110 days of sowing. Data were collected when the foliage turned pale yellow. Data were recorded for 5 individual

plants per plots in each replication. Yield data were also collected after harvest. The plants were separated into leaf, stem and roots and then their dry weight were recorded after drying them in an oven at 80±2^{O}C for 72 hours. The data obtained from the experiment on various parameters were statistically analyzed by MSTAT-C computer program and the mean were adjusted by DMRT where at 5 % levels of probability.

Results and Discussion

Morphological Characters

Plant height

Effect of genotypes and GA_3 showed significant variation in respect of plant height at different days after sowing. The tallest plant (17.63 and 45.97 and 62.53 cm) was obtained from the variety BARI Falon–1 in 33.33 ppm GA_3 followed by the local Falon in similar treatment at 30 and 60 DAS (16.87 and 44.70 cm) and BARI Falon–1 in control treatment at 90 DAS (59.77 cm). Likewise, the shortest plant (13.60, 32.87 and 54.63 cm) was found from the variety local Falon while it was treated by 100 ppm at 30, 60 and 90 DAS, respectively (Table 1). From the above observation, it was found that the plant height was increased accordingly with the advancement of the study. Beside, plant height also increase with the application of GA_3 up to 33.33 ppm after that it decreased at all the data recording stages.

Leaves plant^{-1}

Effect of cowpea varieties and different levels of GA_3 showed significant differences on leaves plant^{-1} whereas the maximum leaves plant^{-1} (9.00, 25.67 and 28.67) was found from 33.33 ppm GA_3 treated plant of BARI Falon-1 while similar GA_3 treatments treated plant of Local Falon produced statistically identical higher production of leaves plant^{-1} at 60 and 90 DAS (25.33 and 28.33, respectively). On the other hand, the minimum leaves plant^{-1} (7.33) was recorded in both 50 and 100 ppm GA_3 treated plant of BARI Falon-1 at 30 DAS while it was also the minimum in control treated plant of Local Falon at 60 DAS (20.33) and 100 ppm GA_3 treated plant of Local Falon at 90 DAS (22.67) (Table 1). Omaima Mohamed *et al*. (2009) found that spraying snap bean plants with 25 ppm vitamin B1 significantly increased number of leaf and branches, dry weight of shoots and total dry weight in both seasons.

Branches plant^{-1}

A highly significant variation was found on branches plant^{-1} to be the effect of two cowpea genotypes and different doses of GA_3 (Table 1). The maximum branches plant^{-1} (4.73, 9.67 and 20.07) was found from the variety BARI Falon-1 in GA_3 at 33.33 ppm foliar spray and it was statistically similar to local Falon in both 33.33 and 50.00 ppm GA_3 at 60 DAS (9.67 and 8.67, respectively) and 50 ppm GA_3 at 90 DAS (19.40). On the other hand, BARI Falon-1 treated by 100 ppm GA_3 produced significantly the minimum branches plant^{-1} (3.33 and 5.83) at 30 and 60 DAS, respectively and control treated plant of Local Felon at 90 DAS (15.67) while statistically similar minimum branches plant^{-1} were taken from 100 ppm GA_3 treated plant of Local Falon at 30 DAS (3.33), and 100 ppm treated plant of both BARI Falon–1 and Local Falon at 90 DAS (15.83 and 15.90, respectively).

Leaf area (LA)

Statistical analysis of the data showed that the leaf area was significantly affected by the effect of varieties and different levels of GA_3 (Table 2). The higher LA (103.73 and 507.34 cm^2 plant^{-1}) was found in 33.33 ppm GA_3 with the variety BARI Falon-1 at 30 and 60 DAS while statistically similar higher LA (100.34 cm^2 plant^{-1}) was also found in similar GA_3 treated plant of Local Falon at 30 DAS. At 90 DAS, the highest LA (2598.45 cm^2 plant^{-1}) was found in 100 ppm GA_3 treated plant of BARI Falon–1. Among other effect, Local Falon showed the lowest LA in 100 ppm GA_3 at 30 DAS and without GA_3 at 90 DAS (80.35 and 1817.10 cm^2 plant^{-1}, respectively) while 25 ppm GA_3 treated plant of BARI Falon–1 showed the lower LA (346.57 cm^2 plant^{-1}) and it was statistically identical to similar GA_3 treated plant of Local Falon (349.31 cm^2 plant^{-1}) at 60 DAS.

Leaf area index (LAI)

LAI showed significant difference due to the effect of varieties and GA_3 levels at 60 and 90 DAS where 30 DAS did not vary significant (Table 2). At 60 DAS,

the maximum LAI (1.153) was found with the variety BARI Falon-1 treated by 33.33 ppm GA_3 and it was statistically similar to the similar GA_3 treated plant of local Falon (1.113) while it was lower (0.903) in 0 ppm GA_3 treated plant of Local Felon which was also statistically similar to 0, 25.00 and50.00 ppm treated plant of BARI Falon–1 (0.933, 0.930 and 0.913, respectively) and 100 ppm GA_3 treated plant of Local Falon (0.943). GA_3 at 33.33 ppm treated plant of local Falon showed the higher LAI (1.133) at 90 DAS followed by similar GA_3 treated plant of BARI Falon (1.060).

Table 1. Effect of varieties and different levels of GA_3 on plant height, leaves plant^{-1} and branches plant^{-1} at different DAS

Varieties	GA_3 levels (ppm)	Plant height (cm)			Number of leaves plant^{-1}			Number of branches plant^{-1}		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
BARI	0 (control)	14.53 ^{d}	35.83 ^{cd}	59.77 ^{b}	8.00 ^{abc}	21.33 ^{de}	24.00 ^{de}	3.67 ^{bc}	6.50^{bc}	16.33^{d}
Falon-1	25	16.63 ^{b}	37.43 ^{bcd}	58.80 ^{bc}	8.33 ^{abc}	23.33 ^{c}	25.67 ^{bc}	4.13 ^{abc}	7.33 ^{b}	17.67^{bc}
	33.33	17.63 ^{a}	45.97 ^{a}	62.53 ^{a}	9.00 ^{a}	25.67 ^{a}	28.67 ^{a}	4.73 ^{a}	9.67 ^{a}	20.07^{a}
	50	16.50 ^{b}	40.50 ^{abc}	57.37 ^{bcd}	7.33 ^{c}	24.67 ^{ab}	26.33 ^{b}	3.90 ^{abc}	7.33 ^{b}	18.17^{b}
	100	13.50 ^{e}	43.17 ^{ab}	55.50 ^{d}	7.33 ^{c}	21.67 ^{d}	24.67 ^{cd}	3.33 ^{c}	6.83 ^{bc}	15.83^{d}
Local	0 (control)	13.53 ^{e}	31.50 ^{d}	56.60 ^{cd}	7.67 ^{bc}	20.33 ^{e}	23.00 ^{e}	3.67 ^{bc}	5.83 ^{c}	15.67^{d}
Falon	25	15.37 ^{c}	34.93 ^{cd}	59.63 ^{b}	8.00 ^{abc}	21.67 ^{d}	25.33 ^{bcd}	4.20 ^{ab}	7.50 ^{b}	17.23^{c}
	33.33	16.87 ^{b}	44.70 ^{a}	59.60 ^{b}	8.67 ^{ab}	25.33 ^{a}	28.33 ^{a}	4.47 ^{ab}	9.67 ^{a}	19.40^{a}
	50	15.57 ^{c}	41.40 ^{abc}	55.57 ^{d}	7.67 ^{bc}	23.67 ^{bc}	25.67 ^{bc}	4.00 ^{abc}	8.67 ^{a}	17.33^{bc}
	100	13.60 ^{e}	32.87 ^{d}	54.63 ^{d}	7.67 ^{bc}	20.67 ^{de}	22.67 ^{e}	3.33 ^{c}	6.67 ^{bc}	15.90^{d}
CV (%)		2.52	9.46	2.70	8.47	2.96	3.05	11.22	8.08	2.82
$LSD_{(0.05)}$		0.6644	6.301	2.686	1.158	1.158	1.333	0.5556	1.053	0.8386

Among other effects, the lower LAI (0.870) was found in 100 ppm GA_3 treated plant of both BARI Falon–1 and local Falon which was also statistically identical to 0, 25.00 and 50.00 ppm GA_3 treated plant of BARI Falon–1 (0.890, 0.943 and 0.880, respectively) and 25.00 ppm treated plant of Local Felon (0.930) at 90 DAS.

Total dry matter (TDM)

Effect of varieties and GA_3 also showed significant variation at 30, 60 and 90 DAS on TDM where the higher TDM (2.90, 33.71 and 83.99 g plant^{-1}) was found in 33.33 ppm GA_3 spraying plant of both BARI Falon–1 at 30, 60 and 90 DAS while local Falon-1 in similar foliar spray of GA_3 showed statistically similar higher TDM at 30 DAS (2.90 g plant^{-1}). GA_3 at 100 ppm showed the lowest TDM with both Local Falon at 30 DAS (2.74 g plant^{-1}) and BARI Falon at 90 DAS (54.95 g plant^{-1}) while without GA_3 treated plant of Local Falon showed the lower TDM (24.26 and 62.) at 60 DAS (Table 2).

Growth characters

Crop growth rate (CGR)

The data on CGR revealed no significant differences at the stage between 30 to 60 DAS but significant at 60 to 90 DAS due to the effect of varieties and different doses of GA_3. As a result, the maximum CGR (1.676 gm^{-2} day^{-1}) was recorded in 33.33 ppm GA_3 treated plant of BARI Falon-1 which was statistically identical to 33.33 ppm GA_3 treated plant of local Falon (1.623 gm^{-2} day^{-1}). Likewise, the lowest CGR (0.849 gm^{-2} day^{-1}) was found in 100 ppm GA_3 treated plant of BARI Falon-1 (Figure 1).

Relative growth rate (RGR)

Effect of varieties and GA_3 showed significant variation at both stages of RGR (Fig. 1). The foliar spray at 33.33 ppm GA_3 treated plant of BARI Falon-1 gave the maximum RGR (0.447 and 0.729 cm^2 day^{-1}) at both stages of 30 to 60 DAS and 60 to 90 DAS, respectively which was statistically similar to 50 ppm GA_3 treated plant of BARI

Falon–1 at the stage between 30 to 60 DAS (0.423 cm^2 day^{-1}). On the other hand, the minimum RGR was recorded in control treated plant of local Falon at 30 to 60 DAS (0.310 cm^2 day^{-1}) and 50 ppm GA_3 treated plant of BARI Falon–1 and control treated plant of Local Falon at 60 to 90 DAS (both similar 0.559 cm^2 day^{-1}).

Table 2. Effect of varieties and different levels of GA_3 on leaf area $plant^{-1}$, Leaf area and dry matter weight at different DAS

Varieties	GA_3 levels (ppm)	Leaf area per plant (cm^2 $plant^{-1}$)			Leaf area index (LAI)			Dry matter weight $plant^{-1}$ (g)		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
BARI Falon-1	0 (control)	89.263 ^{cd}	433.223 ^{cd}	2020.387 ^{efg}	0.65	0.933 ^{b}	0.890 ^{c}	2.80 ^{abc}	25.11 ^{ef}	65.77 ^{d}
	25	81.703 ^{de}	346.573 ^{e}	2426.887 ^{ab}	0.66	0.930 ^{b}	0.943 ^{c}	2.83 ^{abc}	26.69 ^{d}	70.91 ^{c}
	33.33	103.733 ^{a}	507.340 ^{a}	2139.773 ^{def}	0.71	1.153 ^{a}	1.060 ^{ab}	2.90 ^{a}	33.71 ^{a}	83.99 ^{a}
	50	92.977 ^{bc}	485.240 ^{ab}	2151.993 ^{cde}	0.69	0.913 ^{b}	0.880 ^{c}	2.84 ^{abc}	32.01 ^{b}	70.57 ^{c}
	100	82.080 ^{de}	425.800 ^{cd}	2598.847 ^{a}	0.67	0.993 ^{ab}	0.870 ^{c}	2.83 ^{abc}	29.48 ^{c}	54.95 ^{f}
Local Falon	0 (control)	85.967 ^{cde}	396.857 ^{d}	1817.100 ^{g}	0.66	0.903 ^{b}	0.880 ^{c}	2.85 ^{ab}	24.26 ^{f}	62.85 ^{e}
	25	85.407 ^{de}	349.313 ^{e}	2411.910 ^{abc}	0.70	1.037 ^{ab}	0.930 ^{c}	2.77 ^{bc}	25.78 ^{de}	69.67 ^{c}
	33.33	100.340 ^{a}	448.633 ^{bc}	1962.060 ^{efg}	0.70	1.113 ^{a}	1.133 ^{a}	2.90 ^{a}	31.22 ^{b}	79.90 ^{b}
	50	96.767 ^{ab}	436.377 ^{cd}	1875.637 ^{fg}	0.71	0.987 ^{ab}	0.973 ^{bc}	2.86 ^{ab}	29.66 ^{c}	69.21 ^{c}
	100	80.347 ^{e}	388.767 ^{de}	2325.560 ^{bcd}	0.66	0.943 ^{b}	0.870 ^{c}	2.74 ^{c}	27.07 ^{d}	66.27 ^{d}
CV (%)		2.346	4.730	84.38	3.07	5.00	3.89	2.04	2.78	2.34
$LSD_{(0.05)}$		6.969	14.75	250.70	NS	0.1534	0.1085	0.09396	1.357	2.789

Net assimilation rate (NAR)

NAR was significantly affected by the effect of cowpea varieties and different levels of GA_3 at 60 to 90 DAS but a non significant variation was found at 30 to 60 DAS (Fig. 1). At 60 to 90 DAS, 33.33 ppm GA_3 treated plant of BARI Falon–1 gave the maximum NAR (1.275) and 100 ppm GA_3 treated plant of BARI Falon–1 sowed the minimum NAR (0.708).

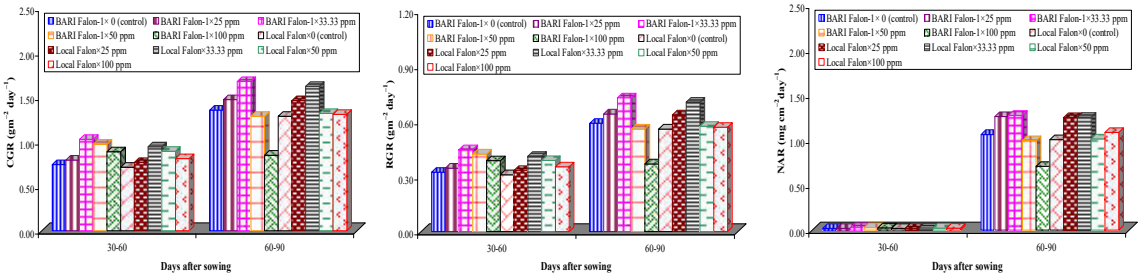

Figure 1. Effect of GA_3 on CGR (A), RGR (B) and NAR (C) at different growth stages

Yield Parameters

Seeds pod^{-1}

Performance of cowpea varieties and GA_3 on seeds pod^{-1} showed significant variation (Table 3). Foliar application of GA_3 at 33.33 ppm gave the maximum seeds pod^{-1} (16.80) with the variety BARI Falon-1 which was closely followed by local Falon (15.67) in similar GA_3 levels. Likewise, minimum seeds pod^{-1} (11.17) was noticed in 100 ppm GA_3 treated plant of local Falon.

Pods $plant^{-1}$

Pods $plant^{-1}$ had also significant due to the effect of varieties and different doses of GA_3 where pods $plant^{-1}$ varied from 7.67 to 11.67. The maximum

pods plant^{-1} (11.67) was found in 33.33 ppm GA_3 treated plant of BARI Falon-1 and it was statistically similar to similar GA_3 treated plant of local Falon (11.33). GA_3 foliar spray at 100 ppm gave the minimum pods plant^{-1} (7.67) with both BARI Falon-1 and local Falon.

Length of pod

A highly significant variation was recorded due to the effect of cowpea varieties and different levels of GA_3. The longest pod (17.20 cm) was found in 33.33 ppm GA_3 treated plant of BARI Falon–1 which was statistically similar to GA_3 treated plant of local Falon (16.90 cm). On the other hand, the shortest pod (13.20 cm) was found in 100 ppm GA_3 treated plant of local Falon (Table 3).

Hundred-seed weight

Effect of varieties and GA_3 on 100-seeds weight showed significant variation where foliar application of GA_3 at 33.33 ppm gave the highest 100-seeds weight (12.49 g) regarding BARI Falon-1 which was closely followed by the local Falon treated by the similar GA_3 (12.02 g). Likewise, the lowest 100-seed (10.37 g) was observed in 100 ppm GA_3 treated plant of local Falon (Table 3).

Seed yield

Responses of varieties and GA_3 had significant on seeds yield (Table 3). Foliar application of GA_3 at 33.33 ppm on BARI Falon–1 gave the higher yield (20.16 g plant^{-1} or 3139.93 kg ha^{-1}) which was statistically differed from other effect. On the other hand, the lowest seeds yield (11.52 g plant^{-1} or 1936.57 kg ha^{-1}) was noticed in 100 ppm GA_3 treated plant of local Falon where the same variety also showed statistically similar seed yield (11.63 g plant^{-1} or 1959.67 kg ha^{-1}) in control treatment. Reddy (2002) also observed seed yield increased significantly with application of NAA 40 and 60 ppm followed by Lihocin (500 ppm) compared to control. Swaminathan *et al*. (2007) recommended that, application of panchagavya at 3 per cent as foliar spray on 15, 25 and 40 DAS recorded significantly highest seed yield (1195 kg /ha) in black gram.

Table 3. Effect of different levels of GA_3 on yield and yield contributing characters at harvest

Varieties	GA_3 levels (ppm)	Pods plant^{-1}	Pod length (cm)	Seeds pod^{-1}	100- seed weight (g)	Seed yield plant^{-1}(g)	Seed yield (kg ha^{-1})	Harvest index (%)
BARI Felon-1	0 (control)	8.333 ^{def}	14.767 ^{cd}	14.43 ^{d}	10.877 ^{de}f	12.443 ^{ef}	2014.533 ^{ef}	18.947 ^{bc}
	25	9.667 ^{cde}	15.467 ^{b}	15.00 ^{c}	11.233 ^{cde}	13.523 ^{d}	2221.700 ^{d}	19.077 ^{bc}
	33.33	11.667 ^{ab}	17.200 ^{a}	16.80 ^{a}	12.490 ^{a}	20.157 ^{a}	3139.933 ^{a}	24.010 ^{a}
	50	10.000 ^{ab}	15.400 ^{b}	14.73 ^{cd}	11.607 ^{bc}	16.350 ^{b}	2668.500 ^{b}	23.177 ^{a}
	100	7.667 ^{f}	14.333 ^{d}	12.73 ^{f}	10.890 ^{def}	13.123 ^{de}	2187.133 ^{de}	23.943 ^{a}
Local Felon	0 (control)	8.333 ^{def}	13.467 ^{cd}	13.97 ^{e}	10.763 ^{ef}	11.633 ^{f}	1959.967 ^{f}	18.573 ^{c}
	25	9.667 ^{bcd}	14.267 ^{b}	13.67 ^{e}	11.420 ^{bcd}	13.033 ^{de}	2198.300 ^{de}	18.710 ^{c}
	33.33	11.333 ^{a}	16.900 ^{a}	15.67 ^{b}	12.017 ^{ab}	16.990 ^{b}	2833.500 ^{b}	20.890 ^{b}
	50	9.000 ^{abc}	15.167^{c}	13.80 ^{e}	11.633 ^{bc}	14.537 ^{c}	2422.700 ^{c}	20.963 ^{b}
	100	7.667 ^{f}	13.200^{de}	11.17 ^{g}	10.367 ^{f}	11.517 ^{f}	1936.567 ^{f}	17.140 ^{c}
CV (%)	CV (%)	7.17	3.50		3.05	4.01	5.24	5.63
$LSD_{(0.05)}$	$LSD_{(0.05)}$	1.148	0.9012		0.5942	0.9854	190.20	1.982

Harvest index (HI)

Effect of varieties and GA_3 levels found to be significant in respect of HI where the maximum HI (24.01%) was found in the foliar spray treatment of GA_3 at 33.33 ppm when the variety was BARI Falon-1 which was also statistically similar to similar variety in 50 and 100 ppm GA_3 (23.18 and 23.94%, respectively). On the other hand, the lowest HI (17.14%) was found in 100 ppm GA_3 and it was also statistically similar with the similar variety in

control and 25 ppm GA_3 (18.57 and 18.71%, respectively).

Conclusion

In view of the above results (all morphological parameters, yield and yield contributing parameters) and discussion, it was concluded that BARI Falon-1 than Local Falon and foliar spray of GA_3 at 33.33 ppm than other levels showed better response on growth and yield attributing characters. Considering the overall performance, it could be also suggested that the variety BARI Falon–1 is more suitable than Local Falon and 33.33 ppm GA_3 than other levels to cultivate in coastal areas of Patuakhali region for getting the higher yield of cowpea.

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