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ENHANCEMENT OF HERBAGE AND SEED YIELD IN *Corchorus olitorius* THROUGH REPEATED CUTTING AGROTECHNIQUE

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Abstract

The effect of repeated cuttings on herbage and seed yield characters were compared in three cultivars of Corchorus olitorius during 2011 and 2012 cropping seasons. Seeds of Corchorus olitorius were steeped in hot water at 97°C for five seconds before sowing by drilling directly on the field. Three different cutting frequencies (for herbage yield) were applied by cutting the stem at 10 cm above the soil (for the first harvest) at 6, 9 and 12 weeks after sowing (WAS) and herbage yield were recorded. At 15 WAS, plant height, number of leaves and number of branches were recorded. After maturity, dry pods were harvested and data were collected on seed yield characters. Data obtained were subjected to analysis of variance and means separation was carried out using DMRT at 5% probability level. The result indicated that herbage yield/plant (25.71g), number of pods/plant (57.94 g) and pod weight/plant (15.76 g) were highest in plants pruned three times while highest seed yield of 8.41 g/plant (1.68 t/ha) were recorded in cutting twice. Among the varieties, Amugbadu recorded highest number of pods/plant, pod weight/plant and seed weight/plant whereas Eleti-Eku had the lowest. However, Eleti - Eku produced the highest 100 seed weight under zero cutting (0.173g). Although cutting three times produced highest herbage yield, but cutting twice is recommended if the objective is for seed production as it recorded highest seed yield.

***Key words**: Corchorus, cutting frequency, herbage yield, seed yield, seed production efficiency.*

Introduction

Corchorus olitorius L. (jews mallow or jute) is one of the major African leafy vegetables which is widely cultivated and traded in tropical and sub-tropical region. It is also a leading leafy vegetable in many parts of Asia, middle-East and the Caribbean (Fondio and Gruben, 2004). The viscosity of its leaves when cooked either fresh or dried is majorly responsible for its wide consumption in the South - western Nigeria. In many urban and peri-urban areas it is grown as backyard or home garden vegetable. The plant is sometimes found as a volunteer in many fields and the dormancy associated with the seed is a major conservation strategy of its germplasm which results in its appearance in many farms years after cultivation.

Normally, African leafy vegetables are grown as a subsistence crop and only the surplus is sold to the markets while farmers prepare and preserve their own seed which in most cases is of poor quality (Schippers, 2002). With increasing demand for this vegetable particularly in urban and peri-urban areas (Chweya and Eyzaguire, 1999), there is a need for increased production and this call for strategies to increase seed production (good quality seed) in order to meet the demand for this vegetable.

Seed yield of 25 g per plant has been reported to be possible if planted at 50 cm x 50 cm (Fondio and Gruben, 2004). Transplanting the seedlings has been reported to be possible but repeated shoot cutting is scarcely practiced. When sown directly, the leaves are harvested once - over by uprooting or cutting at soil level. Shoot harvesting/cutting usually takes place when they are 30 – 40 cm between 3 – 5 weeks after emergence (usually before fruit development). Available reports on some vegetables indicated that cutting at different heights ensures higher seed yield in Amaranthus (Zinati, 2001) faster seed yield in bitter leaf (Schippers, 2000) and increased seed yield in *Corchorus olitorius* (Ahmed and Oladiran, 2012). Regular harvesting of shoots has been reported in bitter leaf which stimulates new growth (Fidelia, 2004). Repeated cutting of leaves of Amugbadu was reported by Fondio and Gruben (2004) to yield 20 - 25 kg (shoot) for a bed of $10m^2$, but seed yield estimate and quality was unavailable. Furthermore, the possibility of obtaining herbage yield for fresh leaf consumption without negative consequence on seed yield will create an alternative economic return and maximise yield per unit area of land by *Corchorus olitorius* seed producers during seed production.

This study is designed to determine the effect of repeated cutting on herbage and seed yield of *Corchorus Olitorius.*

Materials and Methods

Study Area

The study was carried out at the Vegetable Research field of National Horticultural Research Institute (NIHORT), Ibadan, located at an altitude of 168m above sea level, latitude 07° 33'N and longitude 03° 56'E in two cropping seasons (2011 and 2012 respectively).

Experimental Design and Layout

Three cultivars of *Corchorus olitorius* (Amugbadu, Oniyaya and Eleti-Eku) were used for the experiment. In order to remove dormancy, seed lots were treated by steeping in hot water at 97°C for five seconds to improve seedling emergence (Oladiran, 1986). Treated seeds from each variety were sown by drilling directly on the marked plots. Each plot (1m x 4.5m size) contains 10 rows with a spacing of 50 cm between rows. The seedlings were thinned along the rows at 10 cm between plants. Two rows were assigned to each cutting frequency as five plants were tagged in each row. The study was a factorial in a randomized complete block design with three replications. The treatments were zero/no cutting (control), cutting once, cutting twice and cutting three times. Shoot cutting (herbage harvesting) commenced at 6 weeks after sowing (WAS) and subsequently at 3 weeks interval till 12 WAS.

Data Collection

At 15 WAS (beginning of flowering), data were collected on plant height, stem girth and number of branches. Cumulative shoot yield (herbage yield) was recorded for each treatment. At maturity, number of pods/plant, seed weight per plant and 100 seed weight for each treatment were recorded. Seed Production Efficiency (SPE) was also determined as reported by Abdul-Rafiu et al, (2004) using –

SPE = (Dry pod weight /dry seed weight) x 100

Statistical Analysis

Data collected were subjected to analysis of variance and significant means were separated using Duncan's Multiple Range test at 5% level of probability.

Results

The growth characters of three cultivars of *Corchorus olitorius* at 15 WAS under different cutting frequencies (Table 1) revealed that significant variation in plant height was observed among the three cultivars with Amugbadu exhibiting the highest (90.83 cm) while cultivar Eleti-Eku had the lowest (64.21 cm). In contrast, number of branches and stem girth were highest in Eleti-eku with 14.83 and 12.25 mm (respectively) and lowest in Amugbadu with 11.88 and 10.80 mm respectively. Increase in cutting frequency significantly reduced plant height from 115.89 cm in zero cutting to 48.50 cm in cutting thrice. The number of branches increased with increase in cutting frequency from 10.83 in zero cutting to 15.78 in cutting thrice. Stem girth also increased in the same pattern.

Seed and herbage yield characters of the three cultivars of *C. olitorius* subjected to three cutting frequencies (Table 2) showed that Amugbadu and oniyaya had higher number of pods/plant (45.45 and 45.33 respectively) while Eleti-Eku produced lower number of pods/plant (31.92). Pod weight/plant and unit pod weight were also similar and higher in both Amugbadu and Oniyaya compared to Eleti Eku.

Table 1. Growth characters of three cultivars of *Corchorus olitorius* at 15 WAS under different cutting frequency.

Treatment	15 Weeks after sowing		
	Plant height (cm)	No of branches	Stem girth (mm)
Cultivar			
Amugbadu	90.83a	11.88c	10.38c
Oniyaya	80.63b	13.04b	11.00b
Eleti- Eku	64.21c	14.83a	12.25a
Cutting Frequency			
No cutting	115.89a	10.83d	8.61d
Once	85.77b	12.67c	11.16c
Twice	64.06c	13.72b	11.89b
Thrice	48.50d	15.78a	13.17a

Means followed by same letter along the column are not significantly different from one another according to DMRT at 5% level of probability.

Table 2. Seed and herbage yield of three cultivars of *Corchorus olitorius* subjected to different cutting frequencies.

Treatment	No of Pods/plt	Pod wt/plt (g)	Unit pod wt (g)	Seed Wt/plt (g)	Seed Wt/ha (tons)	SPE (%)	100 seed wt (g)	Herbage Yield/ plt (g)	Herbage Yield (t ha^{-1})
Variety									
Amugbadu	45.45a	16.02a	0.35a	9.12a	1.82a	56.93a	0.142b	11.15a	2.23a
Oniyaya	45.33a	15.18a	0.33a	7.94b	1.59a	52.31b	0.140b	11.61a	2.32a
Eleti- Eku	31.92b	8.14c	0.26b	3.86c	0.77b	47.42c	0.148a	11.75a	2.35a
Cutting Frequency									
No cutting	29.72d	11.57b	0.39a	6.52b	1.30b	56.35b	0.162a	0.00d	0.00d
Cutting once	35.61c	11.81b	0.33b	6.34b	1.27b	53.68b	0.154b	5.09c	1.02c
Cutting twice	40.33b	13.31a	0.33b	8.41a	1.68a	63.19a	0.142c	15.23b	3.05b
Cutting thrice	57.94a	15.76a	0.27c	6.72b	1.34b	42.64c	0.127d	25.71a	5.14a

Means followed by same letter along the column are not significantly different from one another according to DMRT at 5% level of probability.

Wt - weight, plt - plant, SPE - Seed production efficiency.

Furthermore, seed weight/plant was highest in Amugbadu with 9.12 g, followed by Oniyaya with 7.94 g while Eleti-Eku produced the lowest with 3.86 g/plant. The seed yield ha-1 was also highest in Amugbadu (1.82 tons) and lowest in Eleti-Eku (0.77 tons). Amugbadu also exhibited the highest seed production efficiency (SPE) of 56.93 % while 47.42 % was recorded by Eleti-eku which was the lowest. In contrast, the 100-seed weight was highest in Eleti-eku with 0.148g while Amugbadu and Oniyaya recorded similar weight with 0.142 and 0.140 g respectively. Herbage yield per plant and per ha were not significantly different among the three varieties.

The table further shows that cutting frequency significantly affects seed yield characters and herbage yield. Corchorus plants cut three times produced the highest number of pods/plant (57.94) followed by cutting twice with (40.3 pods) whereas the lowest number of pods was produced in zero cuttings with 29.72 pods. Similarly, highest pod weight/plant of 15.76 g and 13.31 g were produced by the Corchorus cut three times and twice, respectively while no cutting and cutting once yielded lower pod weight/plant. The unit pod weight was lowest in cutting thrice with 0.27g while the highest was produced by no cutting with 0.39 g. However, cutting once and twice produced similar unit pod weight of 0.33 g respectivile. On the other hand, seed weight per plant was higher in Corchorus cut twice with 8.41g while the other treatments produced similar seed weight per plant. Seed yield ha-1 followed the same trend observed in seed weight/plant. SPE was highest in cutting twice with 63.19 % whereas no cutting and cutting once had similar SPE as the lowest was obtained in cutting thrice. The 100-seed weight reduced with cutting frequency as the highest value was produced in no cutting with 0.162 g and this was significantly reduced to the lowest (0.127 g) in cutting thrice. In contrast, herbage yield increased with cutting frequency as cutting thrice produced highest herbage yield of 25.17g per plant at no cutting recorded no yield. The herbage yield/ha showed similar trend with herbage yield/plant.

Herbage yield/plant as well as herbage yield (t ha-1) were similar in the three cultivars under each cutting frequency (table 3). Herbage yield increases in the three cultivars as cutting frequency increases as the highest herbage yield was obtained in the three cultivars when cut three times. The number of branches also showed similar trend as it increased with

increasing cutting frequency among the cultivars. However, the highest number of branches was obtained in Eleti-Eku pruned three times (18) and this was followed by Oniyaya cut three times with 16.16 branches. The number of branches was lowest in both Amubgadu and Oniyaya under no cutting with 9.0 and 10.17, respectively. The number of pods per plant was 64.83 in Oniyaya cut three times which was the highest among the treatments while the

Table 3. Interaction effect of cutting frequency and variety on herbage and seed yield characters of *Corchorus olitorius*

Cutting Frequencies	Cultivar	Herbage weight (g/Plant)	Herbage yield (ha^{-1})	No. of branches $plant^{-1}$	No. of pods $plant^{-1}$	Pod weight (g/plant)	Seed weight (g/plant)	Seed yield (ha^{-1})	SPE (%)	100 seed weight (g)
No Cutting	Amugbadu	0.00d	0.00d	9.00e	34.00de	13.71cd	7.83bcd	1.57c	57.11b	0.158c
	Oniyaya	0.00d	0.00d	10.17e	36.50de	16.31abc	9.05b	1.81b	55.49bc	0.154c
	Eleti-Eku	0.00d	0.00d	13.33dc	18.66f	4.67g	2.69f	0.54d	57.60b	0.173a
Once	Amugbadu	5.45c	1.09c	12.16d	32.00de	11.13de	6.30cd	1.26c	56.60b	0.154c
	Oniyaya	5.30c	1.06c	12.33d	30.00fe	10.13ef	5.83de	1.17c	57.55b	0.145d
	Eleti-Eku	4.53c	0.91c	13.50cd	44.67dc	14.17cd	6.88bcd	1.38c	48.55e	0.165b
Twice	Amugbadu	14.61b	2.92b	13.17cd	51.17bc	20.42a	13.05a	2.61a	63.91a	0.147d
	Oniyaya	15.36b	3.07b	13.50cd	44.83dc	16.94abc	8.55bc	1.71b	50.47cde	0.143de
	Eleti-Eku	15.70b	3.14b	14.50bc	25.00fe	6.92fg	3.62ef	0.72d	52.31cd	0.139e
Thrice	Amugbadu	24.55a	4.91a	13.16cd	60.67ab	17.15abc	8.58bc	1.72b	50.03cde	0.128f
	Oniyaya	25.78a	5.16a	16.16b	64.83a	18.16ab	8.48bc	1.70b	46.70f	0.122g
	Eleti-Eku	26.78a	5.36a	18.00a	34.00de	6.79fg	3.10f	0.62d	45.66f	0.115h

Means followed by same letter along the column are not significantly different from one another according to DMRT at 5% level of probability.

lowest was produced in Eleti –Eku under zero cutting with 18.66 pods per plant. The highest pod weight per plant was produced by Amubgadu under cutting twice with 20.42 g and this was followed by Oniyaya cut thrice with 18.16 g whereas Eleti- Eku under no cutting had the lowest (4.67 g). Seed weight per plant obtained in Amugbadu under cutting twice was highest with 13.05 g while Eleti-Eku under no cutting produced the lowest (2.69 g) among the treatments. Similarly, the seed yield ha^{-1} was highest in Amugbadu under cutting twice with 2.61 tons and this was followed by Oniyaya under no cutting with 1.81 tons. The lowest seed yield ha^{-1} was obtained in Eleti-eku under no cutting with 0.54 t ha^{-1}. Seed production efficiency (SPE) of 63.91 % was recorded for Amugbadu under cutting twice whereas 45.66 % SPE (lowest) was obtained in Eleti-Eleku under cutting three times. In terms of the 100 - seed weight, Eleti Eku under no cutting had the highest with 0.173 g and this was followed by Eleti Eku under cutting once (0.165 g). Similar 100-seed weight values were observed for Amugbadu and oniyaya under no cutting and Amugbadu under cutting once with 0.158, 0.154 and 0.154 g respectively while Eleti eku under cutting thrice exhibited lowest 100- seed weight of 0.115 g.

Discussion

The result from this study practically demonstrated the variations observed among the three cultivars as they exhibited different agronomic characters. Their leaves are morphologically different as well as their growth. Mavengahama and Lewu (2012) have previously reported morphological variations among wild *C. olitorius.* Expectedly, highest plant height under no cutting resulted in the lowest branching and stem girth while highest branching and stem girth was stimulated by cutting three times resulting in the lowest plant height. This agreed with the findings of Munguatosha *et al*, (2017) that traits such as primary branches, number of branches and plant height prove to be superior in contributing to biomass yield.

Across the cutting frequency, Eleti-eku had slowest growth but with highest branching ability as well as stem girth. Although, most of the branches in the Eleti-Eku were short with short pods unlike the Amugbadu and Oniyaya. Materechera and Medupe (2006) have previously reported that frequent cutting encouraged production of many leaves in Amaranthus but did not allow the leaves sufficient time to grow.

However, Amugbadu exhibited highest plant height and seed production efficiency. Seed yield characters were similar and generally higher in both Amugbadu and Oniyaya. The effect of cutting frequency induced variation across the cultivars in respect of herbage and seed yield characters. Increase in cutting frequency resulted in more number of branches, number of pods per plant, pod weight per plant and herbage yield. This is a clear consequence of higher number of branches stimulated by cutting. However, cutting frequency resulted in reduction of 100-seed weight which may be due to inadequate availability of assimilates for seed development since leaves that synthesize the assimilates are constantly being removed. Similar result was observed by Idowu *et al* (2014) with *Solanum scabrum* as shoot yield increased with successive harvesting but decreased in *Solanum macrocarpon* with increasing number of harvest. In contrast, 100-seed weight was found to be highest under no cutting which may also be attributed to availability of adequate assimilates produced by the leaves since they were not cut. Furthermore, increase in pod weight and number of pods due to increase in cutting frequency did not ultimately translate to increase in seed yield throughout. Seed yield increased significantly in the three cultivars in response to cutting frequency up to cutting twice but declined after the third cutting. This may be due to inadequate seed filling of the pods, resulting from inadequate availability and transfer of assimilates to the seed from the pods. The study further showed that the more the cutting frequency, the higher the branching ability and size of stem girth but lower plant height. This is in line with the observation of Maboko and Du Plooy (2012) who observed that harvesting by cutting delays inflorescence development as well as plant maturity but enhances growth and yield of *Amaranthus tricolor*).

In conclusion, this study may be a simple and adoptable crop manipulation strategy for *Corchorus* seed producer to increase seed production per area to meet the growing demand for this vegetable. Similarly, cutting frequency can be adopted for seed production in Corchorus and similar leafy vegetables to delay the reproductive stage when long unpredictable rainfall is observed. In this study, considerable variations were observed among the three Corchorus cultivars utilized in terms of growth and yield as Amugbadu and Oniyaya gave better herbage and seed yield. Repeated cutting is also practicable in *Corchorus* with dual benefits to the seed producers (revenue from both herbage and seed).

Cutting three times gave the highest herbage or shoot yield and may be adopted by farmers interested in fresh leaf (herbage) production while cutting twice gave the best seed yield with dual advantage. Cutting twice is therefore recommended for good seed yield. Investigation into the quality of seed obtained through this method is also advocated.

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