

The influence of harvesting frequencies on green pod and dry seed productions of Cowpea [*Vigna unguiculata* L. Walp] Ramshorn cultivar obtained from three varying seed production companies.

تأثير فترات الحصاد في انتاج القرينات الخضراء والجافة للوبيا
[*Vigna unguiculata* L. Walp Ramshorn cultivar]
المنتج من ثلاثة شركات عالميه لانتاج البذور

Caser G. Abdel* and Mohammed S. S. D. Al-Slem**

* Horticulture Department, Agriculture Faculty, Dohuk University, Dohuk, Kurdistan Region, Iraq

** Ministry of Technological Science, Seed Technology Center Mosul, Iraq

Abstract

An attempt was made to evaluate the variation in green pod and dry seed production of Ramshorn Cowpea cultivar produced by three varying seed companies as influenced by harvesting frequencies. Therefore, green pods were either continuously harvested around the growing season, harvested four, six times, eight times and continuous dry pod harvest. The highest green pod yield (2.041 kg.m⁻²) were obtained from continuous green pod harvesting treatment, gradual reduction in green pod yields were confined with gradual reductions in harvesting frequencies. Contrary results were found with dry seed yield where gradual yield reductions were accompanied with gradual increases in green pod harvesting frequencies. Consequently, the highest seed yield (0.29859kg.m⁻²) was observed in continuous dry pod harvesting treatment. The best Ramshorn producing seed company was the Italian since it gave the highest green pod and dry seed yields (1.42997 and 0.12713 kg.m⁻², respectively). The highest green pod and yield (2.12203kg.m⁻²) was obtained from Genex source of continuously green pod harvested interaction. The paramount dry seed yield (0.34236kg.m⁻²) was concomitant with Genex source of continuous dry pod harvest.

الخلاصة

اجريت محاولة لقيم التباين في انتاج القرينات الخضراء والجافة لصنف اللوبيا رامشورن بين شركات جنكس والايطالية ومودستو المنتجه لهذا الصنف المحصول كقرينات خضراء خلال فترة النمو او اربعة او ستة مرات او ثمان مرات حصداً كقرينات خضراء والباقي كقرينات جافة بالاضافه الى معاملة الحصاد المستمر كقرينات جافة. اعلى حاصل للقرينات الخضراء 2.041 كغم للمتر المربع حصل عليه من معاملة الحصاد المستمر للقرينات الخضراء وحصل انخفاض تدريجي متماشيا مع انخفاض فترات الحصاد للقرينات الخضراء على العكس من ذلك حصل انخفاض تدريجي في حاصل البذور الجاف متماشيا مع زيادة الحصداً للقرينات الخضراء حيث كان اعلى حاصل للبذور الجافة 0.29859 كغم للمتر المربع كان مرافقا للحصاد المستمر للقرينات الجافة. كان افضل انتاج لحاصل القرينات الخضراء 1.42997 كغم للمتر المربع وحاصل ابذور الجاف 0.12713 كغم للمتر المربع لصنف رامشورن المنتج من الشركة الايطالية. افضل حاصل حصل عليه من مصدر جنكس المحصول كقرينات خضراء بشكل مستمر 2.12203 كغم للمتر المربع و كبذور جافة لنفس الشركة كحصاد مستمر للقرينات الجافة 0.34236 كغم للمتر المربع.

Key words: Cowpea, Green pod, Dry seed, Variations in seed production sources
Corresponding Author: Dr. Caser G. Abdel, caser.abdel@yahoo.com

Introduction

In cowpea, the final seed yield is dependent upon the number of pods per plant, number of grains per pod and the extent to which grains are filled. In the present study, the reduction in seed yield under water stress was associated with dramatic decrease in all these yield components. The

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significant reduction in number of harvested pods per plant under water stress may be attributed to the abscission of the reproductive structures. Whereas the reduction in number of seeds per pod and seed size under water stress treatments may be attributed to the limitation of dry matter partitioning to the reproductive sink or even seed formation factors (Ahmed and Suliman, 2010). Turk and Hall (1980) attributed the reduction in seed yield under drought to the secondary detrimental effects of drought avoidance on CO₂ assimilation. Ravindra *et al.* (1990) attributed the loss in seed yield to low fruiting efficiency and lack of filling time for pods. Continuous removal of immature pods sustain continuous leaves and inflorescence productions. However, leaving pods on plants to mature resulted in reduced pod production (Abdel, 2011). The objective of this study was to find out the variation of Ramshorn cowpea cultivar among three seed producing companies namely Italian, Genex and Modesto.

Materials and Methods

This experiment was conducted at the Research Field, Horticulture Department, Agriculture and Forestry College, Mosul University, Mosul (Latitude 36^o, 20"; Longitude 44^o, 58"; Altitude 230 m). The objective of this investigation was to evaluate the responses of Ramshorn cowpea plants raised from seeds purchased from Italian, Modesto and Genex Seed Companies to three varying irrigation levels.

A Split Plot within Factorial Randomized Complete Block Design (Split Split F-RCBD) was chosen for this trail, where the main plot was irrigation levels (A) which was represented by continuous green pod harvest (a₁), four times green pods harvest (a₂), six times green pods harvest, eight times green pods harvest (a₃) and no green pods harvest only dry pods were harvested (a₄). The sub main plot was three sources (B) of Ramshorn seeds which was represented by seeds obtained from Italian Seed Company (b₁), Modesto Seed Company (b₂) and Genex Seed Company (b₃). Thus, 12 treatments were included in this trail; a treatment was replicated three times and one replicate was represented by 4 furrows each of 1x0.85 m, planted on both sides with a plant intra space of 5 cm.

Field soil (table, 1) was plowed twice on April 8, 2006, dissected according to the proposed design then one gypsum block was settled at a depths of 30 cm from each furrow ridge to truck the soil moisture fluctuations brought up by re-watering (Abdel, 2006a). Meteorological data was recorded in Al-Rashidia Meteorological Center, Mosul City (table, 2). Ramshorn seeds that were purchased from Italian, Modesto and Genex companies were tested before sowing in the permanent field. Their germination percentages and rates were, respectively, (94%; 6.87 seeds.d⁻¹), (82%; 7.08 seeds.d⁻¹) and (87%; 7.61 seeds.d⁻¹). Furrows were watered previous sowing, next day on April 17th, seeds were sown at a 5 cm soil depth. Thinning was made on May 17th, leaving 5 cm between plants. Plants were fertilized three times by Diamen Phosphate (DAP) at rate of 10 g.m⁻² on May 10th, May 23rd, and June 21st. In addition to that

Irrigation dates were determined by the calibration equation that obtained from practical measurement of current resistance OHM versus soil available water capacity (AWC depletion % = 1.6382 x OHM – 32.0127). Pod number, pod length, seed per pod, aborted seeds per pod, aborted ovules per pod, pod fresh weight, dry seed yield, green pod yields, root length, plant fresh weigh were recorded. Samples of root, stem, leaves, and pods were weighed then oven-dried at 65^oC for 72 hrs. Then samples were re-weighed to calculate root, leaves, stems, pods and plant dry weight and dry matter percentages. Finally this experiment was terminated on October 25.

Table (1). Physical analysis for trans located silty loam soil beyond 30 cm depth and clayey underneath native field soil		
Soil separations (g.kg ⁻¹)	Translocated soil	native soil
Clay particles	564	139
Silt particles	313	564
Sand particles	123	297
Soil bulk density (g.cm ⁻³)	1.6	1.55
Soil field capacity (%)	21.8	20
Soil wilting point (%)	12.05	11

Table (2):Meteorological data (Rashida Meteorological Center)						
Parameters	May	June	July	August	Sept.	Oct.
MaxT ⁰ C	32	41	42.1	45	38.2	30.6
Min T ⁰ C	17.4	22.6	25.7	27.3	18.1	16.6
R.H. %	49	30	30	29	35	52

Results and Discussion

1. Vegetative Growth

The influence of harvest frequencies:

The obtained results (Table, 3) revealed that continuous harvest of green pod was the most potent treatment; it gave the highest vegetative growth traits. It substantially exceeded eight harvests in terms of leaf number per plant (5.818%), leaf area index (10.49%) and root fresh weight (10.628%). Additionally, this treatment also exceeded these of dry pod harvest, four and six harvest treatments in all detected parameters.

The next effective treatment was eight harvest frequencies of green pods; it surpassed that of six harvests in plant length (11.21%), plant fresh weight (7.78%), plant dry weight (16.82%), leaf number per plant (14.93%), leaf area (18.69%) and leaf area index (31.66%). Moreover, it showed superiority over four harvests in plant length (6.71%), plant fresh weight (13.78%), plant dry weight (29.28%), leaf number per plant (34.61%), leaf area (42.22%), leaf area index (77.1%) and root fresh weight (11.74%). Eight harvest treatment was also paramount over dry pod harvest treatment in plant length (30.33%), plant height (12.3%), plant fresh weight (24.9%), plant dry weight (56.89%), leaf number per plant (36.47%), leaf area (46.1%), leaf area index (118.99%) and root fresh weight (21.32%).

Finally, dry pod harvest was the worst treatment as it manifested the lowest vegetative traits, as compared to other treatments. From these results, it can be deduced the apparent influence of harvest types on growth stature due to the repartition of assimilate between leave, shoot and pod generations after each harvest which reconstitute photosynthetic translocations. Since cowpea plants at flowering, setting and pod swelling stages are synchronized with shoot and leave generations where a high completion among vegetative and reproductive organs. However, during juvenility such competitions are absent, and thus pod removal may shift the completion type to the juvenility. Subsequently, Continuous pod removal treatment gave the best vegetative growth parameters as compared to other treatments, particularly no green pod harvest treatment where pods were left on plants and harvested at dry mature stage (Abdel, 2011).

Growth variations raised by seed sources

The obtained results (3) exhibited the superiority of Italian source of Ramshorn cowpea cultivar over Genex company seed source of the mentioned cultivar in plant length (9.1%), plant fresh weight (3.96%), leaf number per plant (6.7%), leaf area index (13.79%) and root fresh weight (11.78%). Moreover, Italian source also exceeded Modesto company seed source in plant length (17.68%), plant height (8%), plant fresh weight (7.11%), plant dry weight (7.99%), leaf number per plant (8.6%), leaf area index (17.82%) and root fresh weight (20.85%). The obvious variations among seed producing sources might be attributed to the techniques that had been adopted by these producing companies which resulted in varying capabilities in genome expressing. Lines and cultivar differences are clear in plant texta and such differences were reported by (Abdel and Al-slem, 2010)

Harvest frequencies and seed source interaction

Italian source plant of continuous green pod harvest was the paramount interaction treatment as it revealed the highest values of plant height (106.95 cm), plant length (69.03), leaf number per plant (49.9), leaf area (25.2 cm²), leaf area index (2.51), plant fresh weight (2786.8 g.m⁻²), plant dry weight (682.3g.m⁻²) and root fresh weight (21.5g). The differences in the responses of varying seed sources to harvesting frequencies might be attributed to the varying capabilities of these plants in CO₂ fixation, photosynthesis and assimilate production (Abdelbagiet al., 2000).

Table (3) The effects of harvesting frequencies on growth of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		Ph	Pl	Pl fwt	Pl dwt	R fwt	L/P	La	Lai
Harvesting types	Hgp	92.04a	64.12a	2650.4a	654. 2a	18.3a	46a	24. 6a	2.14a
	Hds	67.42d	54. 97d	2076.5d	409. 1c	13.7c	31.9d	16.7c	0.9f
	H4gp+s d	73.46c	57.85c d	2279. c	496.5b	14.8c	32.3d	17.1c	1.09d
	H6gp+s d	79.02b	59.12b c	2406. 6b	549.4b	16.2b	37. 8c	20. 5b	1.41c
	H8gp+s d	87.88a	61.73a b	2593.8a	641.9a	16.6b	43.5b	24.3a	1.94b
Seeds Source	Italian	86.71a	61.94a	2488a	572.6a	17.5a	40.2a	21a	1.64a
	Modesto	73.7c	57.33b	2322.9c	530.3b	14.5b	37b	20.6a	1.4b
	Genex	79.5b	59.41a b	2393.2b	547.8a b	15.6b	37.7b	20. 8a	1. 44b
Hgp	Italian	106.95a	69.03a	2786.8a	682.3a	21.5a	49.9a	25.2a	2.51a
	Modesto	82.32bc	60.8bc d	2540.4bc	635ab	17.12bc	43.1bc	23.7a	1.861cd
	Genex	86.9b	62.6bc	2623.9b	645.3a	16.4bcd	45.03b c	24.8a	2.05bc
Hds	Italian	69.62de	55.3de	2116.7gh	421de	13.8cde	30.7e	16.6d	0.836j
	Modesto	63.7e	52.5e	2012.5h	386.8e	11.9e	32.6de	16.3d	0.863j
	Genex	69de	57.13c e	2100.3gh	419.6d e	15.3bcde	32.4de	17.04d	0.953hj
H4gp+sd	Italian	73.3cde	57.9ce	2369.8de	523.6c	15.9bcde	32.2de	17.7cd	1.1395g h
	Modesto	69.45de	56.4ce	2172.4fg	464cde	12.5de	31.3e	18.14c d	1.04hj
	Genex	77.7bcd	59.3bd	2296.74ef	501.9c	15.33bcd	33.40d	18.2cd	1.103h

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					d	e	e		
H6gp+sd	Italian	85.7b	61.6cd	2394.03cd e	551.4b c	17.8abc	41.23c	21.2b	1.544e
	Modesto	73.53cd e	57.07c e	2402.5cde	545.2b c	15.2bcde	36.07d	20.6b	1.364ef
	Genex	77.9bcd	58.8cd e	2423.2cde	551.7b c	15.5bcde	36.20d	19.7bc	1.311fg
H8gp+sd	Italian	98.02a	65.95a b	2773a	684.7a	18.43ab	46.93a b	24.6a	2.1721b
	Modesto	79.42bc d	59.95b d	2486.5bcd	620.2a b	15.64bcd e	42.07c	24.06a	1.8384c d
	Genex	86.2b	59.3bd	2521.9bcd	620.7a b	15.60bcd e	41.43c	24.3a	1.7974d

*Hgp=Harvesting green pod ; Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four times and the rest were left for dry seed; H6gp+sd= Harvesting green pods six times and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight times and the rest were left for dry seed ; P h = plant height (cm); Pl = plant length; Pl fwt = plant fresh weight (g); Pl dwt = plant dry weight (g.m⁻²); R fwt = root fresh weight (g.m⁻²); L / p = leaf number per plant; La = leaf area (cm⁻²); Lai = leaf area index .ae=abcde.

2. Flowering

The influence of harvest frequencies

The highest final flower number per plant was confined to cowpea plants harvested six times (table, 4). Since this treatment significantly bypassed four times green pod harvest at the 7th and 8th by 38.78 and 22.73%, respectively, besides its superiority over dry pod harvest at 4th, 5th, 7th and 8th harvests by 41.5, 52.74, 100.2 and 19.71%, respectively. However, the lowest value at harvest 8th was confined to six harvest treatment. Dry pods harvest was the worst treatment in flower generations, as it gave the lowest flower number per plant by (72.82 flower per plant). These results suggested that pod removal showed plant efficacy to generate more flowers which may be due to substitute for the lost pods to sustain further progeny through producing seeds from the newly generated flowers (Abdel, 2006).

Seed resources

The best seed source was Genex company (Table, 4) as it profoundly exceeded that of Italian at 1st and 7th and gross flower number by 55.06, 34.48 and 8.36%, respectively, and over Modesto source at 4th, 5th and 6th and gross flower number per plant by 36.05, 26, 32.57 and 15.29%, respectively. Ahmed *et al.* (1993a) confirmed that certain cultivars and lines such CB5 completely ceased their flower generation at 33^oC day and 30^oC night. They attributed their results to flower bud damage, whereas heat resistance cultivars such as L7964 showed profuse flower production without fruit setting and no bud damage which was referred to anther damage. However, they mentioned a high heat resistant lines for instance L518.

Harvest frequencies and seed sources interaction

Continuous harvest of Genex appeared to be the paramount dual treatment as it gave the highest number of flower per plant (93.43flower.Plant⁻¹) and it substantially exceeded that of Modesto of dry pods harvest, four green pods harvest, Italian dry pods harvest. The worst dual treatment was Modesto dry pods harvest (65. 43flower.Plant⁻¹). No doubt pod removal had an impact on cowpea plants which differ among seed sources grown under prevailing environment (table, 2). Variation might be attributed to plant status acquired from pod removal and to the capability of these plants to behave under high temperature. Heat stress during vegetative growth and earlier reproductive phase of cowpea grown under long day which possesses a clear role on inflorescence initiation, particularly at the 5th node (Faisal *et al.*, 1993). They found that flower initiations were halted at 30^oC night temperatures, however, initiations were improved at 20^oC. Heat

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pulses were not perceived the high night temperature but plant can be perceived heat at certain bud development phase that adversely influence bud development.

Table (4) The effects of harvesting frequencies on flower number per plant at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*											
Detected Traits		FNP _{H1}	FNP _{H2}	FNP _{H3}	FNP _{H4}	FNP _{H5}	FNP _{H6}	FNP _{H7}	FNP _{H8}	FNP _{H9}	Total
Harvesting types	Hgp	5.40a	14a	11.4a	12.34a	9.23ab	5.81ab	9.20ab	11.7a	6.8ab	85.84a
	Hds	5.51a	15.4a	12.3a	9.11b	7.11b	4.92b	5.9c	7.7b	4.98ab	72.8b
	H4gp+sd	5.24a	13.7a	12.01a	13.3a	11.47a	8.12a	8.51bc	5.94c	4.29b	82.6b
	H6gp+sd	5.33a	14.44a	13.12a	12.89a	10.86a	5.96ab	11.81a	7.29b	5.47ab	87.17a
	H8gp+sd	5.06a	11.98a	11.59a	12.16a	10.46a	6.56ab	10.6ab	11.19a	7.56a	87.13a
Seeds Source	Italian	4.05b	14.40a	12.88a	12.77a	9.65a	6.61ab	7.83b	8.65a	5.63a	82.46b
	Modesto	5.6a	12.87a	11.25a	9.79b	8.77b	5.25b	9.25Ab	8.48a	6.24a	77.5c
	Genex	6.28a	14.42a	12.09a	13.32a	11.05a	6.96a	10.53a	9.13a	5.59a	89.35a
Hgp	Italian	4.93a	14.63ab	13.10a	12.93ab	8.50ac	5.50ac	7.70ce	10.67ae	5.40bd	83.37ac
	Modesto	5.13a	12.03ab	10.03a	9.7bc	8.68ac	4.8ac	9.63ad	12.3ab	8.4ab	80.7bc
	Genex	6.13a	15.33ab	11a	14.4a	10.53ab	7.13abc	10.27ac	12.03ac	6.6bc	93.43a
Hds	Italian	4.03a	16.37a	12.43a	7.87c	7.17bc	3.5c	4.7e	7.9bf	5.57bd	69.53de
	Modesto	5.33a	14.7ab	10.6a	6.7c	5.57c	4.57bc	5.5de	8.07bf	4.4cd	65.43e
	Genex	7.17a	15.03ab	13.73a	12.77ab	8.6ac	6.7abc	7.5ce	7.03df	4.97bd	83.5ac
H4gp+sd	Italian	3.7a	13.33ab	14.03a	15.37a	11.63ab	8.67a	8.13be	6.07ef	5.07bd	86ac
	Modesto	5.93a	13.33ab	11.23a	12.6ab	10.3ab	6.93abc	7.8ce	5.9f	2.8d	76.83cd
	Genex	6.1a	14.4ab	10.77a	11.9bc	12.47a	8.77a	9.6ad	5.87f	5bd	84.87ac
H6gp+sd	Italian	3.87a	15.37a	13.73a	13.5ab	10.17ab	6.87abc	10.43ac	7.7cdef	5.4bd	87.03ac
	Modesto	6.17a	13.77ab	13.1a	10.13bc	9.43abc	5.17ac	12.33ab	6.5df	5.3bd	81.9ac
	Genex	5.97a	14.2ab	12.5a	15.03a	12.97a	5.83ac	12.67a	7.67cf	5.7bd	92.57a
H8gp+sd	Italian	3.7a	12.3ab	11.1a	14.17a	10.8ab	8.5ab	8.2be	10.9ad	6.7bc	86.37ac
	Modesto	5.43a	10.5b	11.27a	9.8bc	9.9ac	4.8ac	11ac	9.63af	10.3a	82.63ac
	Genex	6.03a	13.12ab	12.4a	12.5ab	10.57ab	6.37ac	12.6a	13.03a	5.67bd	92.4ab

*Hgp=Harvesting green pod;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; FNP_H = =Flower number per plant harvest.ae=abcde.

3. Pod development

Harvesting frequencies

Continuous green pod harvesting appeared to be the most potent treatment (tables, 5-11). It gave the highest final pod number per plant and pod length as compared to others. This treatment exceeded dry pods harvest treatment in pod number 53.33%, weight of fresh pods at all harvests by ∞ , pod dry weight at 1st and 7th harvests by ∞ and 69.57%, respectively, seed number per pod at 1st, 7th harvests and final seed number per pod by ∞ , 116.55 and 11.4%, respectively, pod length at 1st, 2nd, 3rd, 5th and 7th harvests by ∞ , 8.06, 11.9, 14.82 and 122.5%, respectively. Moreover, continuous green pod harvest gave the lowest aborted seeds and ovules per pod. However, it manifested the lowest pod number per plant at 5th and 6th harvests, pod dry weights at 2nd, 3rd, 4th, 6th, 8th and 9th harvests and individual pod dry weight and its seed number at 5th harvest.

Dry pod harvests treatment was categorized in the final fifth sequence order, since it revealed the lowest green pod fruiting characteristics. However, it significantly reduced aborted seeds and ovules per pod. It significantly by passed continuous green pod harvest treatment in pod number per plant at 5th harvest by 39.66%, weight of dry pod at 2nd to 5th harvests by 36.85, 26.91, 38.25 and 40.21%, respectively, seed number per pod at 5th harvest by 19.1%. In addition to that, it exhibited substantial reductions in aborted seeds per pod at 1st, 4th, and 7th harvest by ∞ , 41.45, and 67.23%, respectively, and in the final aborted seeds per pod 25%. It also exhibited huge reduction in aborted ovules per pod at 1st, 4th and 7th harvests and in the final aborted ovules per pod by ∞ , 50.7, 102.63, and 30.29%, respectively. The obtained results confirmed the variations resulted from different harvesting frequencies in all fruiting traits which might be attributed to plant recovery capacities after pod removals which reflected the assimilate utilizing ability for substituting the lost organs to keep seed production for further generations. Seeds and ovules are usually aborted by fertilization failure owing to pollen defects or stigma reception failure for pollen grain (Abdel and Al-Rawi, 2011), or assimilate shortages owing to plant capability to produce assimilate or translocation and partitioning of these assimilate (Ehlers and Hall 1996).

Seed sources

The obtained results (tables, 5-11) manifested that Ramshorn plants raised from Genex seeds source gave the highest total pod number per plant and seed number per pod besides the lowest aborted ovules and seeds per pod. Genex was significantly exceeded Modesto in terms of pod number per plant at 4th to 7th harvests and total pod number per plant by 51.96, 85.27, 59.7, 68.35 and 27.35%, respectively, green pod fresh weight at 3rd to 7th harvests and total green pod fresh weight by 12.46, 14.83, 19.5, 67.89, 36.68 and 11.78%, respectively, dry pod weight at 3rd to 7th harvests and total dry pod weigh by 18.07, 33.87, 41.8, 79.11, 55.54 and 49.51%, respectively, seeds number per pod at 1st, 4th, 5th and 7th harvests by 27.29, 29.08, 27.59, 42.36, and 18.5%, respectively, pod length at 7th harvest by 34.41%, final mean of pod length by 6.48%. Genex showed significant aborted seeds per pod at 1st to 5th harvest and final aborted seeds per pod by 62.96, 65.71, 50.24, 24.38, 29.95 and 17.67%, respectively, aborted ovule number per pod at 3rd to 5th and final aborted ovules by 31.67, 51.38, 46.94 and 18.91%, respectively. Genex source displayed superiority over Italian source in pod number per plant at 1st and 5th harvest by 52.17 and 86.72%, respectively, seeds number per pod at 5th harvest by 2.4% and gross seeds number per pod by 5.32%. Moreover, Genex source manifested huge reductions in aborted seeds per pod at 2nd and 3rd harvest by 36.57 and 26.57%, respectively, aborted ovules per pod at 4th by 26.6%, as compared to Italian source.

The worst source was Modesto as it gave the lowest pod number per pod, weight of green pod, weight of dry pod and seed number per pod, pod length. Moreover, Modesto source showed the highest aborted seed number per pod besides the highest aborted ovules per pod. This source exceeded Italian in pod number per plant at 1st harvest by 47.83%, besides its lowest aborted seeds per pod at 7th by 33.16% as compared to Genex. From field observation Genex plants commenced into flowering earlier than other two sources, such earliness may be attributed to capability of these

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plants to convert their vegetative meristems into reproductive ones within short duration owing to its genome expressions. The worse results that accompanied to Modesto source might be due to weakness in assimilate synthesis or their distributions under the ambient high temperature, particularly during July and August (table, 2). Combination influences were found between leaf senescence and heat resistance in cowpea, where heat susceptible cultivars displayed earlier leaves senescence (Abdelbagiet *al.*, 2000).

Harvest frequencies and sources combinations

Genex plant of continuous green pods appeared to be the most potent interaction treatment (table, 5-11). It gave the highest final pod number per plant and pod number per plant at 1st harvest. However, it showed reduced pod number per plant at 6th and 9th harvests. The worst interaction treatment was Modesto of dry pod (No green pod harvest). Since this dual treatment gave the lowest pod number of pods per plant at 1st and 7th harvest, the lowest gross pod number at the end of the growing season, pod dry weight at 1st, 6th and 7th harvests, final mean of seeds number per pod at 1st, 2nd, 6th and 7th harvests. Significant differences were not detected between Modesto of dry pod harvest and other dual treatments revealed the highest values of aborted seeds per pod at 2nd, 5th, 8th and 9th harvest, aborted ovules per pod at 2nd, 3rd, 8th and 9th harvests. However, dry pod harvest of Modesto gave the highest pod number per plant at 3rd and 5th harvests, pod dry weight at 2nd to 5th harvests. The variations observed among combination treatments might be due to the capabilities of individual source in expressing their genomes, and therefore there should a gene conversion, deletion, addition and translocations in Ramshorn cultivar among these producing companies which reflected on their field performance, if which otherwise there would be no differences occurred.

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Table (5) The effects of harvesting frequencies on pods number per plant at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		PNP H1	PNP H2	PNP H3	PNP H4	PNP H5	PNP H6	PNP H7	PNP H8	PNP H9	Total
Harvesting types	Hgp	3.24a	7.31a	4.62ab	3.6a	1.74b	0.99b	3.54a	4.07a	1.96a	31.08a
	Hds	0c	2.54c	5.97a	4.03a	2.43a	1.47b	0.8c	1.11b	1.91a	20.27c
	H4gp+sd	2.2b	5.17b	3.81b	3.91a	0c	4.41a	2.2b	1.94b	1.12a	24.77b
	H6gp+sd	2.35b	5.42b	3.8b	3.9a	1.97a _b	0.97b	0c	4.09a	2.12a	24.62b
	H8gp+sd	2.95a	6.72a	4.66ab	3.48a	2.12a _b	1.22b	3.66a	3.27a	2.69a	30.76a
Seeds Source	Italian	1.61b	6.05a	5.23a	4.27a	1.28b	1.95a _b	1.8ab	2.51a	2.07a	26.85a
	Modes to	2.38a	4.64b	4.08b	2.81b	1.29b	1.34b	1.58b	2.73a	2.04a	22.89b
	Genex	2.45a	5.61a _b	4.41ab	4.27a	2.39a	2.14a	2.66a	3.5a	1.77a	29.15a
Hgp	Italian	2.73a _{bc}	8.27a	5.57ab _c	3.9ab	1.33b _c	0.8b	3.23ab _{cd}	3.7ab	1.6bcd _e	31.13ab _c
	Modes to	3.7ab _c	6.2ab _c	3.7bcd	2.4b	1.4bc	0.67b	3.17ab _{cd}	4ab	2.7abcd _d	27.57ab _c
	Genex	3.93a	7.47a _b	4.33ab _{cd}	4.5ab	2.5ab	1.5b	4.23ab	4.5a	1.57bc _{de}	34.53a
Hds	Italian	0d	1.93f	6.47a	4.7ab	1.8b	1.77b	0.9de	0.77c	1.7bcd _e	20.03ef
	Modes to	0d	2.27e _f	5.53ab _c	3.5ab	1.63b	0.87b	0e	0.9c	1.5bcd _e	16.2f
	Genex	0d	3.43d _{ef}	5.9ab	3.9ab	3.87a	1.77b	1.5cde	1.67b _c	2.53ab _{cd}	24.57cd _e
H4gp+sd	Italian	1.5cd	6.03a _{bc}	4.53ab _{cd}	4.57a _b	0c	4.47a	2.43bc _d	1.5c	1.37cd _e	26.1bcd _e
	Modes to	2.5ab _c	4.43c _{de}	3.4cd	3.07a _b	0c	3.57a	1.4cde	2.23a _{bc}	0.77e	21.37de _f
	Genex	2.6ab _c	5.03b _{cd}	3.5cd	4.1ab	0c	5.2a	2.77ab _{cd}	2.4ab _c	1.23de	26.83bc _{de}
H6gp+sd	Italian	1.55c	6.5ab _c	4.67ab _{cd}	4.23a _b	1.43b _c	1b	0e	3.7ab	2.9ab	25.99cd _e
	Modes to	3abc	4.5cd _e	3.2d	2.67a _b	1.73b	0.8b	0e	4ab	1.73bc _{de}	21.63de _f
	Genex	2.5ab _c	5.27b _{cd}	3.53cd	4.8a	2.73a _b	1.1b	0e	4.57a	1.73bc _{de}	26.23bc _{de}
H8gp+sd	Italian	2.27b _c	7.5ab	4.9abc _d	3.93a _b	1.83b	1.73b	2.83ab _{cd}	3.2ab _c	2.8abc	31abc
	Modes to	3.33a _b	5.8ab _{cd}	4.3abc _d	2.43b	1.7b	0.8b	3.33ab _c	2.5ab _c	3.5a	27.7abc _d
	Genex	3.23a _b	6.87a _{bc}	4.77ab _{cd}	4.07a _b	2.83a _b	1.13b	4.8a	4.1ab	1.77bc _{de}	33.57ab

*Hgp=Harvesting green pod;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four times and the rest were left for dry seed; H6gp+sd= Harvesting green pods six times and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight times and the rest were left for dry seed;PNPH = pods number per plant harvest.

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Table (6) The effects of harvesting frequencies on individual pod fresh weight (g) at(Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	Mean s	
Harvesting types	Hgp	6.29 3a	6.207a	6.824a	5.851a	5.091 a	4.009 a	5.627 a	6.544 a	6.90 7a	5.928 a	
	Hds	0b	0b	0b	0b	0b	0b	0b	0b	0b	0b	
	H4gp+sd	6.93 5a	6.158a	6.178ab	5.707a	0b	0b	0b	0b	0b	5.745 a	
	H6gp+sd	6. 367a	5. 836a	5. 642ab	5.429a	4.86a	4. 891a	0b	0b	0b	0b	5.843 a
	H8gp+sd	6.59 5a	5.949a	5.582b	5.573a	4.747 a	4.271 a	6.029 a	6.129 a	0b	0b	5.808 a
Seeds Source	Italian	5.52 2a	6.644a	7.005a	6.568a	4.373 ab	4.78a	4.756 a	6.592 a	6.98 7a	6.338 a	
	Modes to	5.18 4a	6.388a	5.795b	5.212b	3.765 b	3.183 b	2.868 c	6.359 a	6a	5.322 c	
	Genex	5.00 9a	6.358a	6.517a	5.985a	4.499 a	5.344 a	3.92b	6.189 a	6.12 4a	5.949 b	
Hgp	Italian	6.78 a	6.373a bc	7.293ab c	6.42ab	5.287 a	3.293 ab	6.827 ab	7.273 a	7.15 3a	6.3a	
	Modes to	6.24 7a	5.98bc	6.153cd e	5.46ab c	4.787 a	3.187 ab	5.327 bc	6.28a b	6.61 3a	5.559 ab	
	Genex	5.85 3a	6.267a bc	7.027bc d	5.673a bc	5.2a	5.547 a	4.727 c	6.08a b	6.95 3a	5.925 ab	
Hds	Italian	0b	0d	0f	0d	0b	0c	0d	0c	0b	0c	
	Modes to	0b	0d	0f	0d	0b	0c	0d	0c	0b	0c	
	Genex	0b	0d	0f	0d	0b	0c	0d	0c	0b	0c	
H4gp+sd	Italian	7.06 7a	6.453a bc	6.86bcd	6.493a b	0b	0c	0d	0c	0b	6.703 a	
	Modes to	7.28 a	6.06bc	5.56de	4.563c	0b	0c	0d	0c	0b	5.862 ab	
	Genex	6.46 a	5.96bc	6.113cd e	6.033a bc	0b	0c	0d	0c	0b	6.141 a	
H6gp+sd	Italian	6.65 7a	5.987b c	6.213bc de	5.793a bc	4.947 a	4.947 ab	0d	0c	0b	5.757 ab	
	Modes to	5.95 3a	6.073b c	5.013e	4.94bc	4.48a	4.14a b	0d	0c	0b	5.099 ab	
	Genex	6.49 3a	5.447c	5.7cde	5.553a bc	5.153 a	5.587 a	0d	0c	0b	5.655 ab	
H8gp+sd	Italian	7.10 7a	5.933b c	5.88cde	6.087a bc	4.9a	4.654 ab	7.64a	6.6ab	0b	6.1ab	
	Modes to	6.44 a	5.913b c	4.947e	5.013b c	4.427 a	2.8ab	4.94c	5.853 ab	0b	4.236 b	
	Genex	6.24 a	6bc	5.92cde	5.62ab c	4.913 a	5.35a	5.507 bc	5.933 ab	0b	4.905 ab	

*Hgp=Harvesting green pod;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed; H = harvest.

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Table (7) The effects of harvesting frequencies on individual pod dry weight (g) plant at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	Means
Harvesting types	Hgp	1.68 2a	1.71b	1.743b	1.404 b	1.23 6b	0.965a	1.231 ab	1.66 3a	1.763 a	0.965a
	Hds	0b	2.34a	2.212a	1.941 a	1.73 3a	1.107a	0.785 c	1.55 a	1.56a	1.107a
	H4gp+sd	1.88 2a	1.605 b	1.673b	1.412 b	0c	1.278a	1.14b	1.80 6a	1.266 a	1.57a
	H6gp+sd	1.68 2a	1.553 b	1.502b	1.292 b	1.15 7b	1.132a	0d	1.82 1a	1.654 a	1.535a
	H8gp+sd	1.76 2a	1.581 b	1.454b	1.408 b	1.12 4b	0.976a	1.47a	1.59 a	1.843 a	0.976a
Seeds Source	Italian	1.50 2a	1.811 a	1.904a	1.697 a	1.09 9a	1.203a	1.243 a	1.77 a	1.791 a	1.389a
	Modes to	1.36 a	1.73a	1.489b	1.246 c	0.89 b	0.742b	0.623 c	1.63 4a	1.5a	0.923b
	Genex	1.34 2a	1.732 a	1.758a	1.531 b	1.16 2a	1.329a	0.969 b	1.65 4a	1.561 a	1.38a
Hgp	Italian	1.87 a	1.73b cd	1.903b cd	1.626 bc	1.25 6b	0.823a bc	1.763 ab	1.92 3a	1.853 ab	0.823bc de
	Modes to	1.66 a	1.67c d	1.42def	1.273 cd	1.13 6b	0.716b c	1.116 c	1.49 a	1.66a b	0.716cde
	Genex	1.51 6a	1.72b cd	1.83bc de	1.313 cd	1.31 6b	1.356a bc	1.07c	1.57 6a	1.776 ab	1.356abc d
Hds	Italian	0b	2.406 a	2.473a	2.226 a	1.86 6a	1.623a	0.973 c	1.33 6a	1.606 ab	1.623ab
	Modes to	0b	2.24a bc	1.993b c	1.616 bc	1.33 6b	0.49c	0d	1.58 6a	1.463 ab	0.49e
	Genex	0b	2.373 ab	2.17ab	1.98a b	1.99 6a	1.21ab c	1.383 bc	1.76 6a	1.61a b	1.21abcd e
H4gp+sd	Italian	1.91 a	1.73b cd	1.963b cd	1.613 bc	0c	1.35ab c	1.446 bc	1.86 3a	1.633 ab	1.713a
	Modes to	1.92 3a	1.593 cd	1.42ef	1.05d	0c	1.013a bc	0.936 c	1.79 a	1.003 b	1.4abcd
	Genex	1.81 3a	1.493 d	1.636c def	1.573 bc	0c	1.473a b	1.036 c	1.76 6a	1.163 ab	1.598ab
H6gp+sd	Italian	1.82 a	1.593 cd	1.643c def	1.413 cd	1.21 b	1.126a bc	0d	2.02 a	1.906 ab	1.684ab
	Modes to	1.5a	1.6cd	1.313f	1.08d	0.99 3b	0.88ab c	0d	1.78 3a	1.543 ab	1.402abc d
	Genex	1.72 6a	1.466 d	1.55cde f	1.383 cd	1.27 b	1.39ab	0d	1.66 a	1.513 ab	1.521abc
H8gp+sd	Italian	1.91 3a	1.586 cd	1.536c def	1.606 bc	1.16 3b	1.103a bc	2.03a	1.70 6a	1.956 a	1.103abc de
	Modes to	1.72 a	1.55c d	1.223f	1.213 cd	0.98 3b	0.61bc	1.02c	1.52 0a	1.83a b	0.61de
	Genex	1.65 3a	1.606 cd	1.603c def	1.406 cd	1.22 6b	1.216a bc	1.356 bc	1.54 3a	1.743 ab	1.216abc de

*Hgp=Harvesting green pod;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed;H= harvest.

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Table (8) The effects of harvesting frequencies on seed number per pod at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	Means
Harvesting types	Hgp	8.31ab	9.13 a	9.06a	9.22a	7.23bc	5.49a	9.16a	8.14a b	8.13a	8.22a
	Hds	0.00c	8.37 a	8.88a	8.80a	8.73a	5.40a	4.23c	7.09b	7.57a	7.38b
	H4gp+sd	7.58b	9.22 a	8.89a	8.57a	0d	7.34a	7.61b	7.37a b	5.83a	7.81ab
	H6gp+sd	8.31ab	8.34 a	8.99a	8.13a	6.78c	6.08a	0d	8.72a b	8.11a	7.93ab
	H8gp+sd	9a	9.02 a	8.47a	8.21a	7.86b	5.97a	9.09a	8.99a	8.38a	8.33a
Seeds Source	Italian	6.76a	8.71 a	8.61a	9.06a	6.13b	6.65a	6.15a	7.82a	8.26a	8.09b
	Modesto	5.79b	8.59 a	8.87a	7.29b	5.40c	6.91a	4.91b	8.03a	7.06b	7.19c
	Genex	7.37a	9.22 a	9.1a	9.41a	6.89a	6.91a	6.99a	8.33a	7.5ab	8.52a
Hgp	Italian	8.47ad	8.9a	9.1ab	10.07a	7.37be	4.57a b	9.1ab	8.13a	9.07a	8.3ac
	Modesto	7.18cd	8.6a	9ab	7.7bd	6.2de	4.7ab	8.5ab	7.9a	7.6ab	7.49cd
	Genex	9.3ab	9.9a	9.13a b	9.93a	8.43ab c	7.2ab	9.87a	8.4a	7.7Ab	8.87a
Hds	Italian	0e	8.37 a	9.17a b	8.7abc	8.87ab	8.3a	5.27c	5.8a	7.77a b	7.78bc d
	Modesto	0e	7.93 a	8.2ab	8.6abc d	7.93ab cd	2.37b	0d	7.23a	6.83a bc	6.14e
	Genex	0e	8.8a	9.26a b	9.1ab	9.4a	5.53a b	7.43a bc	8.23a	8.1a	8.23ab c
H4gp+sd	Italian	7.93ab cd	9.3a	8.23a b	9.2ab	0f	7.33a	7.83a bc	7.47a	7.4ab	8.09ab c
	Modesto	6.5d	9.47 a	8.8ab	6.87cd	0f	6.2a	6.67b c	6.87a	4.87c	7.03d
	Genex	8.3abc d	9.2a	9.63a b	9.63ab	0f	8.5a	8.33a b	7.77a	5.23b c	8.33ab c
H6gp+sd	Italian	8.23ab cd	7.83 a	8.6ab	8.77ab c	6.63cd e	5.93a b	0d	8.77a	7.9a	7.83bc d
	Modesto	7.4bcd	8.17 a	9.83a	6.7d	5.9f	5.63a b	0d	9a	8.07a	7.59cd
	Genex	9.3ab	9.03 a	8.53a b	8.93ab	7.8abc d	6.67a b	0d	8.4a	8.37a	8.37ab c
H8gp+sd	Italian	9.17ab c	9.13 a	7.93b	8.57ab cd	7.8abc d	7.1ab	8.6ab	8.93a	9.17a	8.49ab c
	Modesto	7.87bc d	8.77 a	8.53a b	6.63d	6.97cd e	4.17a b	9.37a b	9.17a	7.9a	7.71cd
	Genex	9.97a	9.17 a	8.93a b	9.43ab	8.8ab	6.63a b	9.3ab	8.87a	8.07a	8.8ab

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four times and the rest were left for dry seed; H6gp+sd= Harvesting green pods six times and the rest were left for dry seed; H8gp+sd = Harvesting green pods eight times and the rest were left for dry seed ; H = harvest .

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Table (9) The effects of harvesting frequencies on pod length (cm) at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	means
Harvesting types	Hgp	16.65a	17.477 ab	16.872 a	15.195 a	15.838 a	11.27 8ab	17.92 2a	16.61 ab	16.53 a	16.53a
	Hds	0b	16.17c	15.196 b	14.37a	13.794 b	9.144 b	8.056 c	15.06 1b	16.38 3a	16.38a
	H4gp+sd	17.111 a	16.59c	17.33a	15.177 a	0c	13.94 4a	15.18 3b	16.61 7ab	12.32 8a	15.707 a
	H6gp+sd	16.338 a	17.616 a	16.544 a	15.238 a	15.55a	14.48 3a	0d	17.24 6a	16.61 7a	16.055 a
	H8gp+sd	16.177 a	16.7bc	16.6a	14.598 a	14.677 ab	12.75 ab	18.33 3a	17.24 9a	15.96 a	15.96a
Seeds Source	Italia n	14.599 a	18.646 a	17.986 a	16.055 a	13.09a	13.46 3a	13.14 5a	18.39 3a	17.75 3a	17.781 a
	Mode sto	12.49b	15.937 b	15.736 b	14.102 b	11.19b	10.04 a	9.62b	15.43 b	13.86 b	14.82c
	Gene x	12.68b	16.15b	15.805 b	14.596 b	11.636 b	13.45 7a	12.93 a	15.85 b	15.07 8b	15.781 b
Hgp	Italia n	18.4ab	19.023 ab	18.35a b	16.4a	17.416 a	10.25 ab	19.56 7a	18.57 7ab	18.25 a	18.25a
	Mode sto	15.533 d	16.69c de	16.333 abcd	14.353 bc	14.983 bcd	9.883 ab	16.96 7ab	15.49 3c	15.23 3ab	15.233 de
	Gene x	16.016 cd	16.72c de	15.933 bcd	14.833 abc	15.116 bcd	13.7a b	17.23 3ab	15.87 3c	16.11 7a	16.116 bcde
Hds	Italia n	0e	18.053 abcd	16.383 abcd	15.226 abc	14.8cd	13.21 7ab	10.28 3c	16.46 7bc	17.85 a	17.85a b
	Mode sto	0.00e	15.193 e	14.680 d	13.840 c	12.183 e	4. 33b	0d	13.93 3c	14.76 7ab	14.77d e
	Gene x	0.00e	15.276 e	14.527 d	14.066 c	14.400 cd	9.883 ab	13.88 3bc	14.78 3c	16.53 3a	16.533 abcd
H4gp+sd	Italia n	18.600 a	18.546 abc	18.967 a	16.366 a	0.00f	14. 55ab	15.66 0ab	18.57 7ab	16.73 3a	17.842 ab
	Mode sto	16.250 cd	15.606 e	18.167 bcd	14.016 c	0.00f	12.48 3ab	13.75 0bc	15.49 3c	9. 393c	14.284 e
	Gene x	16.483 bcd	15.610 e	16.867 abcd	15.150 abc	0.00f	14.80 0a	16.13 7ab	15.78 3c	10.86 7bc	14.995 de
H6gp+sd	Italia n	17.900 abc	19.160 a	18.267 abc	16.283 a	17.100 ab	14.31 7ab	0.00d	19.17 3a	18.30 0a	17.332 abc
	Mode sto	15.450 d	16.580 cde	15.567 cd	14.266 bc	14.916 cd	14.21 7ab	0.00d	16.11 7bc	15.28 3ab	15.182 de
	Gene x	15.666 d	17.110 bcde	15.800 bcd	15.166 abc	14.633 cd	12.91 7a	0.00d	16.45 0bc	16.26 7a	15.651 cde
H8gp+sd	Italia n	18.083 abc	18.450 abc	17.967 abc	16ab	16.133 abc	14.98 3a	20.21 7a	19.17 3a	17.63 3a	17.633 abc
	Mode sto	15.216 d	15.616 e	15.933 bcd	14.033 c	14.866 de	9.283 ab	17.38 3ab	16.11 7bc	14.63 7ab	14.636 de
	Gene x	15.233 d	16.033 de	15.900 bcd	13.763 c	14.033 cde	13.98 3ab	17.40 0ab	16.45 0bc	15.61 0ab	15.610 cde

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest.

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Table (10) The effects of harvesting frequencies on aborted seed number per pod at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*											
Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	means
Harvesting types	Hgp	2.47a	2.51a b	2.54ab	2.73ab	3.12a b	2.52a b	3.01a	2.32 a	2.12 a	2.6a
	Hds	0.00b	1.89b	1.99b	1.93c	2.52b	2.01b	1.77b	2.14 a	2.38 a	2.08b
	H4gp+sd	1.99a	2.12a b	3.04a	2.60b	0.00c	2.52a b	2.96a	2.32 a	1.72 a	2.41a
	H6gp+sd	2.08a	2.73a	2.77ab	3.08a	3.30a	3.49a	0.00c	1.90 a	2.07 a	2.68a
	H8gp+sd	2.37a	2.48a b	2.66ab	2.51b	3.69a	2.91a b	2.53a	2.32 a	1.74 a	2.58a
Seeds Source	Italian	1.77a b	2.39a	2.62b	2.27b	2.37b	2.80a	1.73b	1.79 b	1.97 a	2.34b
	Modesto	2.20a	2.90a	3.11a	3.01a	2.95a	2.52a	1.90b	2.35 a	2.07 a	2.73a
	Genex	1.35b	1.75b	2.07c	2.42b	2.27b	2.75a	2.53a	2.46 a	1.98 a	2.32b
Hgp	Italian	2.277 ab	2.57a bc	2.30cde f	2.13cde f	2.87b c	2.37a b	2.30a bc	1.83 a	2.03 a	2.35cde
	Modesto	2.97a	3.13a b	3.33abc	3.27a	3.73a b	2.37a b	3.23a b	2.60 a	2.23 a	2.99ab
	Genex	1.67a b	1.83b c	2ef	2.80abc de	2.77b c	2.83a b	3.50a	2.53 a	2.10 a	2.45abc de
Hds	Italian	0.00c	1.87b c	1.97ef	1.67f	2.27c	2.70a b	2.10b c	1.37 a	2.23 a	2.02e
	Modesto	0.00c	2.43a bc	2.30cde f	2.17bcd ef	3.30a b	1.17b	0.00d	2.43 a	2.53 a	2.04e
	Genex	0.00c	1.37c	1.70f	1.97def	2c	2.17a b	3.20a b	2.63 a	2.37 a	2.18de
H4gp+sd	Italian	1.93a b	2.30a bc	3.40ab	2.5abcd ef	0.00d	2.30a b	2.53a bc	1.97 a	2.27 a	2.40bcd e
	Modesto	2.40a b	2.60a bc	3.37ab	3.37a	0.00d	2.83a b	3.20a b	2.37 a	1.60 a	2.72abc d
	Genex	1.53b	1.47c	2.4bcde f	1.93ef	0.00d	2.43a b	3.13a b	2.62 a	1.30 a	2.10e
H6gp+sd	Italian	1.67a b	2.73a bc	2.8abcd ef	3.10abc	3.33a b	3.23a b	0.00d	1.73 a	1.67 a	2.53abc de
	Modesto	2.70a b	3.33a	3.43a	3.17ab	3.60a b	3.87a	0.00d	1.87 a	2.20 a	3.02a
	Genex	1.87a b	2.13a bc	2.07ef	2.97abc d	2.97b c	3.37a b	0.00d	2.10 a	2.33 a	2.48abc de
H8gp+sd	Italian	2.47a b	2.47a bc	2.6abcd ef	1.97def	3.37a b	3.40a b	1.70c	2.07 a	1.63 a	2.41bcd e
	Modesto	2.93a b	3ab	3.13abc d	3.10abc	4.10a	2.37a b	3.07a b	2.50 a	1.80 a	2.89abc
	Genex	1.70a b	1.97a bc	2.20def	2.5abcd ef	3.60a b	2.97a b	2.83a bc	2.40 a	1.80 a	2.44abc de

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest .

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Table (11) The effects of harvesting frequencies on aborted ovule number per pod at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	mean s
Harvesting types	Hgp	2.33 a	2.29a b	2. 52ab	3. 21a	3. 13ab	2.9a	3.08a	2.60a	2.37a	2.71a
	Hds	0.00 b	2.03b	2.04b	2.13c	2.49b	1.98a	1.52b	2.24a	2.16a	2.08b
	H4gp+sd	2.04 a	2.94a	2.89a	2.59b c	0.00c	3a	3.53a	2.24a	1.92a	2.65A
	H6gp+sd	2.54 a	2.51a b	2.52a b	2.97a b	3.44a	3.49a	0.00c	2.06a	2.38a	2.74A
	H8gp+sd	2.41 a	2.62a b	2.99a	2.83a b	2.99a b	3.14a	3.23a	2.39a	1.86a	2.72a
Seeds Source	Italian	1.85 a	2.40a	2.67a b	2.76b	2.39b	3a	1.83b	2.16a	2.12a	2.53b
	Modest o	1.95 a	2.60a	2.91a	3.30a	2.88a	3.24a	2.44a	2.38a	2.05a	2.83a
	Genex	1.79 a	2.30a	2.21b	2.18c	1.96b	2.47a	2.55a	2.38a	2.24a	2.38b
Hgp	Italian	2.77 a	2.23a	2.40a b	3.17a d	2.97a d	2.23a b	2.33d e	2.57a	1.90a b	2.51b f
	Modest o	1.90 a	2.73a	2.83a b	3.8a	3.9ab	3.93a	3.23b e	2.5a	2.03a b	2.99a b
	Genex	2.33 a	1.9a	2.33a b	2.67a e	2.53c d	2.53a b	3.67a c	2.73a	3.17a	2.65a d
Hds	Italian	0b	1.97a	1.97b	2.07d e	2.53c d	2.7ab	1.97e	1.7a	1.83a b	2.09ef
	Modest o	0b	2.37a	2.33a b	2.53b e	2.77b d	1.43b	0f	2.97a	2.7ab	2.14d f
	Genex	0b	1.77a	1.97b	1.8e	2.17d	1.8ab	2. 6ce	2.07a	1.93a b	1.2f
H4gp+sd	Italian	1.87 a	2.9a	2.8ab	2.47b e	0e	2.97a b	2.73c e	2.5a	2.67a b	2.61a e
	Modest o	2.43 a	3a	3.47a	3.33a c	0e	3.7ab	4.73a	2.07a	1.67a b	3.05a
	Genex	1.83 a	2.93a	2.4ab	1.97e	0e	2.33a b	3.17b e	2.17a	1.43b	2.28d f
H6gp+sd	Italian	2.63 a	2.7a	3ab	3.23a d	3.33a d	3.4ab	0f	1.83a	2.63a b	2.85a c
	Modest o	2.87 a	2.77a	2.43a b	3.5ab	4.07a	4.14a	0f	2.07a	2.1ab	2.99a b
	Genex	2.13 a	2.07a	2.13a b	2.17c e	2.93a d	2.93a b	0f	2.27a	2.4ab	2.38cf
H8gp+sd	Italian	2a	2.5a	3.17a b	2.87a e	3.13a d	3.7ab	2.13d e	2.2a	1.57a b	2.59a e
	Modest o	2.57 a	2.53a	3.47a	3.33a c	3.67a c	3ab	4.23a b	2.3a	1.73a b	2.98a b
	Genex	2.67 a	2.83a	2.33a b	2.3ce	2.17d	2.73a b	3.33b d	5.933a b	2.59a b	2.59a e

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = = harvest .

4. Yield

Harvest frequencies

Continuous green pod removal gave the highest final green pod yield and the highest pod dry weight yield (table, 12-17). However, continuous green pod removal gave the worst dry pod yield (zero), dry seed yield (zero), green pod yield at 5th harvest only, dry matter of green pod at 5th harvest only, dry matter percentage of green pod and weight of 100 seeds at 2nd to 5th harvests and their final means for both, as compared to dry pod harvest treatments. Dry pod harvest treatment was categorized next at the fourth order in the sequence, since it gave the worst green pods yield (zero) among other investigated treatments (table, 12-17). It gave the lowest pod dry weight and 100 seeds weight at 1st harvest (zero). On the other hand it showed the highest final mean of dry pod yield 350.72 g.m⁻² and the highest final mean of dry seeds yield 298.59 g.m⁻². Dry pod harvest treatment highly bypassed continuous green pods harvest treatment in dry pod yield and dry seeds yield by ∞ , dry matter percentages of pods at 2nd to 5th by 20.3, 20.96, 14.23 and 10.5%, respectively, weight of 100 seeds at 2nd to 5th harvests and final dry seeds yield by 28.58, 25.51, 25.87, 33.04 and 14.26%, respectively. These results suggested that as green pod frequencies increased dry pod and seeds yield were reduced, particularly continuous green pod removal left no chance for dry pods and dry seeds attainments, and thus yields were zero for both. However, growers aimed to produce dry seeds have not to harvest green pods and if they would like to take advantage of green pods green pod removal frequencies should not be exceeded four times for acceptable compromise. In this investigation, green pods yield was considered, since consumers mainly preferred immature and green paled mature cowpea green pods (Abdel and Al-slem, 2010). The controversial balance between green pod and dry seeds yields that accompanied harvest frequencies can be referred to the assimilate partitioning between vegetative and reproductive organs, where under pod removal circumstances the balance is shifted somehow to juvenility which induce plants to be more active in shoots, flower and pods generations. Therefore, plant senescence is delayed and plants are usually produces perfuse pods. In contrast, when pods are left on plants, shoots and pods generation are usually ceased earlier with limited pod number, such phenomenon if prevailed in crops where edible tissues are consumed immature for instance cucumber (Abdel, 2009).

Seed sources

Italian appeared to be the most potent Ramshorn seed source (tables 12-17). It manifested the highest final mean of green pod yield (1429.97g.m⁻²), final mean of 100 seeds weight (22.5g). It highly exceeded Genex in green pod yields at 2nd and 3rd harvests by 16.08 and 16.55%, respectively, weight of 100 seeds at harvests 1st to 5th and 9th harvests and final mean of 100 seeds weight by 13.46, 13.86, 20.86, 18.52, 15.34, 24.57 and 14.16%, respectively. Italian source showed superiority over Modesto in green pod yield at 2nd to 4th harvests and final mean of green pod yield by 30.64, 28.9, 26.4 and 17.25%, respectively, green pod dry weight at 2nd to 4th harvests and green pod dry weight by 33.69, 31.1, 34.59 and 20.15%, respectively, final yield of dry pod 17.92%, final mean of dry seeds yield 18.87%, green pod dry matter percentages at 7th harvest and final green pod dry matter percentage by 25.15 and 6.48%, respectively, weight of 100 seeds at 1st to 7th and 9th harvests and final mean of 100 seeds weight by 13.84, 14.92, 17.81, 13.76, 13.16, 45.64, 43.8, 20.92 and 20.64%, respectively. However, it showed the worst yield of green pod at 1st and 9th harvests.

Modesto was the worst seed source in green pod yield, dry seed yield and green pod dry weight, since it manifested the lowest green pod yield at 2nd to 8th harvests and final mean of green pod yield and weight of green pod dry matter at 2nd to 8th harvests and final mean of green pod dry matter, dry matter percentage of green pod at 2nd to 9th harvests and final mean of green pod dry matter percentages at 2nd, 4th to 7th harvests and final dry pod yield at 2nd and 4th to 8th, final mean

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of dry pod yield, weight of 100 seeds at 1st, 2nd, 6th and 7th harvests, and final mean of 100 seeds weight. The superiority of Italian source plant might be due to its huge vegetative growth of profuse branching as it was apparent in the field which reflected on pod generations. It was found that Ramshorn cowpea cultivars produced by Italian company commenced with vigorous and more uniform seedlings and produced larger plant size as compared to other sources (Abdel and Al-Slem, 2010).

Harvest frequencies and seed sources combinations

Green pod continuously removed from Genex plants dual treatment (tables 12-17) was the best as it gave the highest green pod yield at 1st harvest, final mean of green pod yield, green pod dry matter weight at 1st and 7th harvests, final mean of green pod dry matter. However, it displayed the lowest green pod yield at 2nd, 5th and 9th harvests, green pod dry weight at 3rd, 5th harvests, weight of 100 seeds at 1st to 5th, 8th and 9th harvests and the final mean of 100 seeds weight.

Genex plants harvested as dry pods treatment was the paramount treatment (tables, 12-17). It displayed the highest pod dry weight yield and seeds dry yield at 1st and 4th harvests, final mean of dry seeds yield, pod dry matter percentage at 5th harvest. However, it showed the lowest of dry pod weight at 3rd and 5th to 8th harvests, dry seeds yield at 5th to 7th harvests, pod dry matter percentage at 1st harvest, final mean of 100 seeds weight and 100 seeds weight at 2nd to 5th harvests. All seed sources that were harvested as continuous green pod harvests manifested very low dry pod yield, yield of dry seeds. In contrast all seed sources which were harvested as dry pods revealed the lowest green pods yields.

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Table (12) The effects of harvesting frequencies on yield of green pod (g . m ⁻²) at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*											
Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	Total
Harvesting types	Hgp	209.17 a	367.49 a	305.98 a	298.91 a	124.32 b	79.84 a	228.4 7a	301.8 1a	124.72 a	2040.7 4a
	Hds	0.00b	0.00b	0.00b	0.00b	0.00c	0.00b	0.00b	0.00b	0.00b	0.00d
	H4gp+sd	191.92 a	407.71 a	331.98 a	329.77 a	0.00c	0.00b	0.00b	0.00b	0.00b	1261.3 8c
	H6gp+sd	155.07 a	410.68 a	333.29 a	326.23 a	144.91 b	91.46 a	0.00b	0.00b	0.00b	1461.6 3b
	H8gp+sd	190.94 a	360.22 a	330.78 a	292.21 a	186.59 a	91.85 a	219.1 2a	299.2 5a	0.00b	1970.9 6a
Seeds Source	Italian	126.28 b	353.14 a	296.62 a	265a	86.96a b	59.02 a	97.88 a	125.3 2a	19.751 b	1429. 97a
	Modes to	159.13 a	270.31 b	230.11 b	209.66 b	76.12b	42.47 a	82.51 a	116.4 2a	31.854 a	1218.5 9b
	Genex	162.84 a	304.21 b	254.49 b	273.63 a	110.41 a	56.39 a	88. 16a	118.9 1a	23.226 ab	1392.2 7a
Hgp	Italian	188.76 ac	410.27 ac	340.35 ac	317.49 ad	116.06 cd	71.73 a	249.2 5a	322.8 8a	98.75b	2115.5 a
	Modes to	206ab	323.03 bc	278.83 c	236.11 d	109.97 d	61.03 ab	201.1 2a	309.2 9a	159.27 a	1884.7 bc
	Genex	232.75 a	369.16 bc	288.78 ac	343.14 ab	146.92 bd	106.7 4a	235.0 4a	273.3 7a	116.13 b	2122.0 3a
Hds	Italian	0d	0d	0d	0e	0e	0b	0b	0b	0c	0e
	Modes to	0d	0d	0d	0e	0e	0b	0b	0b	0c	0g
	Genex	0d	0d	0d	0e	0e	0b	0b	0b	0c	0g
H4gp+sd	Italian	156.45 bc	476.76 a	382.24 a	366.23 ab	0e	0b	0b	0b	0c	1377.8 e
	Modes to	224.47 ab	347.67 bc	289.38 bc	282.06 ad	0e	0b	0b	0b	0c	1143.6f
	Genex	194.82 ab	402.7a bc	324.23 ac	341.01 ac	0e	0b	0b	0b	0c	1262.8 ef
H6gp+sd	Italian	118.97 c	469.03 a	375.62 ab	331.85 ac	135.15 bd	105.7 9a	0b	0b	0c	1536.4 d
	Modes to	162.83 ac	361.34 bc	293.17 ac	277.45 bd	119.88 bd	78.4a	0b	0b	0c	1293.0 6ef
	Genex	183.41 ac	401.67 ac	331.07 ac	369.4a	179.69 ac	90.19 a	0b	0b	0c	1555.4 d
H8gp+sd	Italian	167.21 ac	413.62 ab	384.8a	309.41 ad	183.59 ab	117.5 9a	240.1 7a	303.7 2a	0c	2122.0 3a
	Modes to	202.37 ab	319.52 c	289.19 bc	252.65 cd	150.76 bd	72.92 a	211.4 1a	272.8 4a	0c	1777.7 c
	Genex	203.24 ab	347.52 bc	318.35 ac	314.58 ad	225.43 a	85.04 a	205.7 9a	321.2 a	0c	2021.1 3ab

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest .

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Table (13) The effects of harvesting frequencies on weight of poddry matter (g . m⁻²) at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	Total
Harvesting types	Hgp	52.04a	84.07a	70.58 a	69.17a	29.47 b	18.07 a	52.42 a	72.6 1a	28.8 1a	477.24a
	Hds	0b	0b	0b	0b	0c	0b	0b	0b	0b	0e
	H4gp+sd	44.52a	92.39a	76.11 a	74.47a	0c	0b	0b	0b	0b	287.49d
	H6gp+sd	35.53a	93.71a	75.82 a	77.54a	33.08 ab	21.01 a	0b	0b	0b	336.69c
Seeds Source	H8gp+sd	43.26a	78.4a	72.61 a	65.11a	40.96 a	20.59 a	50.32 a	68.6 2a	0b	439.86b
	Italian	29.87b	78.3a	66.46 a	62.3a	19.55 ab	12.75 a	22.23 a	29.0 4a	4.36 b	324.87a
	Modes to	36.73a b	58.57b	50.69 b	46.29b	16.68 b	9.55a	18.38 a	26.3 a	7.19 a	270.39b
Hgp	Genex	38.6a	72.28a	59.92 ab	63.19a	25.88 a	13.49 a	21.04 a	29.4 a	5.74 ab	329.52a
	Italian	50.82a b	96.72a b	79.73 ab	74.8ab c	28.42 b	15.29 a	56.79 ab	75.2 9a	21.7 8c	499.65a
	Modes to	48.82a b	66.67c	61.25 b	52.93c	26.02 b	14.26 ab	42.85 b	73.1 9a	35.9 4a	421.95b c
Hds	Genex	56.46a	88.84a bc	70.76 ab	79.79a b	33.98 ab	24.64 a	57.61 a	69.3 4a	28.7 b	510.13a
	Italian	0d	0d	0c	0d	0c	0b	0c	0b	0d	0h
	Modes to	0d	0d	0c	0d	0c	0b	0c	0b	0d	0h
H4gp+sd	Genex	0d	0d	0c	0d	0c	0b	0c	0b	0d	0h
	Italian	33.65b c	105.64 a	88.19 a	87.85a	0c	0b	0c	0b	0d	315.34e f
	Modes to	54.15a b	74.86b c	61.89 b	60.54b c	0c	0b	0c	0b	0d	251.43g
H6gp+sd	Genex	45.76a bc	96.67a b	78.26 ab	75.03a bc	0c	0b	0c	0b	0d	295.71f g
	Italian	26.17c	104.81 a	83.05 ab	80.2ab	30.26 b	23.53 a	0c	0b	0d	348.02d ef
	Modes to	37.18a bc	81.81a bc	65.39 ab	64.28a bc	25.92 b	17.41 a	0c	0b	0d	292fg
H8gp+sd	Genex	43.23a bc	94.52a bc	79.01 ab	88.15a	43.07 ab	22.07 a	0c	0b	0d	370.05c de
	Italian	38.71a bc	84.33a bc	81.34 ab	68.65a bc	39.09 ab	24.94 a	54.35 ab	69.9 2a	0d	461.33a b
	Modes to	43.51a bc	69.53b c	64.92 ab	53.71c	31.46 b	16.08 a	49.04 ab	58.2 9a	0d	386.55c d
H8gp+sd	Genex	47.55a b	81.35a bc	71.56 ab	72.98a bc	52.32 a	20.74 a	47.56 ab	77.6 3a	0d	471.71a b

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest .

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Table (14) The effects of harvesting frequencies on yield of dry pod for product seeds (g . m⁻²)on at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		FNP H1	FNP H2	FNP H3	FNP H4	FNP H5	FNP H6	FNP H7	FNP H8	Total
Harvesting types	Hgp	0b	0b	0b	0b	0c	0c	0d	0c	0e
	Hds	49.21a	81.68a	68.61a	51.84a	26.99b	14.07b	19.27c	39.04ab	350.72a
	H4gp+sd	0b	0b	0b	0b	69.49a	42.54a	41.4b	27.66b	181.09b
	H6gp+sd	0b	0b	0b	0b	0c	0c	72.16a	43.61ab	115.77c
	H8gp+sd	0b	0b	0b	0b	0c	0c	0d	57.21a	57.21d
Seed Source	Italian	8.84a	18.68a	14.80a	9.78a	19.89a	11.90ab	27.07a	36.24a	147.20a
	Modesto	9.52a	13.87a	13.61a	8.92a	16.25a	7.20b	23.19a	32.29a	124.83b
	Genex	11.17a	16.46a	12.76a	12.4a	21.75a	14.86a	29.44a	31.99a	150.83a
Hgp	Italian	0c	0c	0c	0c	0c	0c	0f	0f	0i
	Modesto	0c	0c	0c	0c	0c	0c	0f	0f	0i
	Genex	0c	0c	0c	0c	0c	0c	0f	0f	0i
Hds	Italian	44.183b	93.4a	74.01a	48.89b	32.27b	14.17c	15.2ef	39.37bcde	361.5b
	Modesto	47.58ab	69.36b	68.03ab	44.61b	17bc	0c	13.35ef	35.17cde	295.09c
	Genex	55.85a	82.28ab	63.79b	62.01a	31.72b	28.03b	29.27de	42.59bcde	395.56a
H4gp+sd	Italian	0c	0c	0c	0c	67.22a	45.34a	37.31cd	30.24de	180.11de
	Modesto	0c	0c	0c	0c	64.23a	35.97ab	35.63cd	22.59e	158.42ef
	Genex	0c	0c	0c	0c	77.03a	46.30a	51.25bc	30.15de	204.73d
H6gp+sd	Italian	0c	0c	0c	0c	0c	0c	82.83a	54.16abc	136.99d
	Modesto	0c	0c	0c	0c	0c	0c	66.98ab	36.38bcde	103.37h
	Genex	0c	0c	0c	0c	0c	0c	66.65ab	40.29bcde	106.95gh
H8gp+sd	Italian	0c	0c	0c	0c	0c	0c	0f	57.41ab	57.41j
	Modesto	0c	0c	0c	0c	0c	0c	0f	67.28a	67.28j
	Genex	0c	0c	0c	0c	0c	0c	0f	46.93abcd	46.93j

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four times and the rest were left for dry seed; H6gp+sd= Harvesting green pods six times and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight times and the rest were left for dry seed ; H = harvest .

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Table (15) The effects of harvesting frequencies on pod dry matter percentage (%) at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	means
Harvesting types	Hgp	24.0 5a	22.56 b	22.85 b	22.91 b	23.13 b	17.48 a	22.95 a	23.08 a	23.02 a	22.45a
	Hds	0b	27.14 a	27.64 a	26.17a	25.56 a	16.62 a	13.87 b	22.7a	23.56 a	22.91a
	H4gp+sd	22.7 7a	22.05 b	22.73 b	22.46 b	0d	24.06 a	25.98 a	25.7a	19.21 a	23.12a
	H6gp+sd	22.8 5a	22.7b	22.76 b	23.77 b	22.68 bc	23.09 a	0c	26.19 a	25.81 a	23.73a
	H8gp+sd	22.3 8a	21.89 b	22.71 b	22.14 b	21.56 c	20.03 a	23.28 a	22.96 a	27.12 a	22.67a
Seeds Source	Italian	18.2 5a	22.72 b	23.9a	24.04a	18.45 a	21.51 a	17.62 a	23.49 a	24.42 a	23.17a
	Modesto	18.2 2a	22.71 b	23.1a	22.72a	17.9a	16.8a	14.08 a	24.11 a	23.03 a	21.76 b
	Genex	18.7 7a	24.38 a	24.21 a	23.71a	19.4a	22.46 a	19.95 a	24.78 a	23.78 a	23.99a
Hgp	Italian	25.1 2a	22.5c	23.08 c	23.24a d	24.03 ac	13.94 ab	23ab	23.23 ab	22.53 ac	22.27 bd
	Modesto	22.9 7a	21.52 c	21.87 c	22.36 bd	22.43 bc	15.5a b	21.54 ab	23.6a b	22.3ac	21.57c d
	Genex	24.0 8a	23.94 ac	23.59 bc	23.12a d	22.91 bc	22.99 ab	24.32 a	22.41 ab	24.21 ab	23.51a c
Hds	Italian	0b	26.97 a	28.19 a	26.55a	25.19 ab	25.06 a	16.27 b	17.76 b	23.31 ac	23.66a c
	Modesto	0b	27.25 a	27.58 a	25.73a c	24.42 ac	8.04b	0c	24.78 ab	22.7ac	20.06 d
	Genex	0b	27.22 a	27.16 ab	26.23a b	27.06 a	16.77 ab	25.35 a	25.56 ab	24.67 a	25a
H4gp+sd	Italian	21.2 8c	21.72 c	22.87 bc	24.09ad	0d	24.27 a	25.17 a	26.4a	25.59 a	23.93a c
	Modesto	24.0 9a	20.41 c	21.3c	21.36 d	0b	23.9a	25.83 a	25.4a b	16.39 bc	22.33 bd
	Genex	22.9 6a	24.02 ac	24.02 bc	21.91c d	0b	24a	26.94 a	25.3a b	15.64 c	23.1ac
H6gp+sd	Italian	21.6 7a	22.15 c	22.24 c	24.06a d	22.13 bc	22.85 ab	0c	26.96 a	24.16 ab	23.28a c
	Modesto	23.0 9a	22.5c	22.33 c	23.13a d	21.88 bc	21.98 ab	0c	25.04 ab	26.47 a	23.31a c
	Genex	23.7 7a	23.45 bc	23.71 bc	24.12a d	24.02 ac	24.46 a	0c	26.56 a	26.79 a	24.61a b
H8gp+sd	Italian	23.1 7a	20.55 c	23.11 c	22.24 bd	20.91c	21.42 ab	23.02 ab	23.09 ab	26.49 a	22.74a c
	Modesto	20.9 5a	21.88 c	22.44 c	21.03 d	20.75 c	14.6a b	23.02 ab	21.7a b	27.3a	21.52c d
	Genex	23.0 4a	23.25 c	22.58 c	23.16a d	23bc	24.06 a	23.15 ab	24.08 ab	27.56 a	23.76a c

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four times and the rest were left for dry seed; H6gp+sd= Harvesting green pods six times and the rest were left for dry seed; H8gp+sd= H4gp+sd= Harvesting green pods eight times and the rest were left for dry seed ; H = harvest .

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Table (16) The effects of harvesting frequencies on yield of dry seeds (g . m⁻²)at (Harvests 1 –9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	Total
Harvestin g types	Hgp	0b	0b	0b	0b	0c	0c	0d	0c	0e
	Hds	41.94a	70.79a	59.66 a	44.70 a	22.29b	12.19b	15.90c	32.12ab	298.59a
	H4gp+s d	0b	0b	0b	0b	56.1a	36.15a	34.23b	22.64b	149.12b
	H6gp+s d	0b	0b	0b	0b	0c	0c	57.8a	35.68ab	93.48c
	H8gp+s d	0b	0b	0b	0b	0c	0c	0d	47.25a	47.25d
Seeds Source	Italian	7.65a	16.19a	12.37 a	8.58a	15.93a	10.30a b	21.70a	29.99a	122.70a
	Modest o	7.96a	11.92a	11.94 a	7.51a	12.86a	6.14b	18.93a	25.98a	103.22b
	Genex	9.56a	14.37a	10.89 a	10.73 a	18.24a	12.57a	24.13a	26.65a	127.13a
Hgp	Italian	0c	0c	0b	0c	0c	0c	0e	0e	0h
	Modest o	0c	0c	0b	0c	0c	0c	0e	0e	0h
	Genex	0c	0c	0b	0c	0c	0c	0e	0e	0h
Hds	Italian	38.26b	80.94a	61.86 a	42.90 b	26.20b	11.27c	11.70e	31.44bcd	304.57b
	Modest o	39.78a b	59.59b	59.67 a	37.54 b	12.57b c	0c	10.66e	28.85cd	248.84c
	Genex	47.79a	71.84a b	54.45 a	53.64 a	27.91b	25.31b	25.33d	36.09abc d	342.36a
H4gp+sd	Italian	0c	0c	0b	0c	53.44a	40.22a	31.20c d	25.1cd	149.97d e
	Modest o	0c	0c	0b	0c	51.56a	30.67a b	29.45c d	17.89de	129.57e f
	Genex	0c	0c	0b	0c	63.29a	37.55a b	42.03b c	24.93cd	167.81d
H6gp+sd	Italian	0c	0c	0b	0c	0c	0c	65.58a	44.33abc	109.91f g
	Modest o	0c	0c	0b	0c	0c	0c	54.56a b	29.09cd	83.64g
	Genex	0c	0c	0b	0c	0c	0c	53.27a b	33.61bcd	86.88g
H8gp+sd	Italian	0c	0c	0b	0c	0c	0c	0e	49.06ab	49.06h
	Modest o	0c	0c	0b	0c	0c	0c	0e	54.07a	54.07h
	Genex	0c	0c	0b	0c	0c	0c	0e	38.63abc	38.63h

*Hgp=Harvesting green pod ; Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest

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Table (17) The effects of harvesting frequencies on weight of 100 seeds (g) at (Harvests 1 – 9) of Ramshorn cowpea cultivar obtained from three varying sources*

Detected Traits		H1	H2	H3	H4	H5	H6	H7	H8	H9	means
Harvesting types	Hgp	19.51 a	19.07b	19.52 b	19.23 b	17.92 c	14.6b	19.92 b	20.01 a	19.44 a	18.8c
	Hds	0b	24.52a	24.5a	24.21 a	23.9a	16.3ab	13.9c	20.96 a	23.52 a	21.48 a
	H4gp+sd	19.82 a	19.28b	19b	19.51 b	0d	23.83a	24.5a	24.16 a	19.21 a	21.16 a
	H6gp+sd	18.66 a	19.58b	19.78 b	19.71 b	19.2b	18.4ab	0d	24.64 a	23.87 a	20.48 ab
	H8gp+sd	19.56 a	19.51b	19.31 b	18.99 b	18.61 bc	16.63a b	18.99 b	19.6a	24.33 a	19.5b c
Seeds Source	Italian	16.86 a	22.26a	22.89 a	22.4a	17.37 a	20.87a	17.5a	22.91 a	25.25 a	22.5a
	Modes to	14.81 b	19.37b	19.43 b	19.69 b	15.35 b	14.33b	12.17 b	21.59 a	20.71 b	18.65 c
	Genex	14.86 b	19.55b	18.94 b	18.9b	15.06 b	18.66a b	16.71 a	21.12 a	20.27 b	19.71 b
Hgp	Italian	20.83 ac	20.2cf	22.27 bc	20.77 cd	18.57 d	12.7bc	21.9a b	22.17 ac	20.87 ad	20.03 ce
	Modes to	18.8c d	18.37e f	19.2d e	17.9ef	17.37 d	12.37b c	18.73 b	19bc	18.43 cd	17.79 e
	Genex	18.9c d	18.63d f	17.1e	19.03 df	17.83 d	18.73a c	19.13 ab	18.87 bc	19.03 bd	18.59 e
Hds	Italian	0e	26.7a	27.4a	27.07 a	26.67 a	25.9a	18.23 b	17.3c	25.83 ab	24.45 a
	Modes to	0e	22.97b c	23.93 b	22.37 bc	22bc	7.53c	0c	23.07 ac	23.3a c	18.05 e
	Genex	0e	23.9b	22.93 bc	23.2b	23.03 b	15.47a c	23.47 ab	21.97 ac	21.43 ac	21.93 bd
H4gp+sd	Italian	22.2a	21.37b d	20.8c d	21.87 bc	0e	26.03a	26.93 a	26.33 ab	26.8a	24.04 ab
	Modes to	18.93 cd	19.03d ef	18e	18.23 ef	0e	22.53a b	23.3a b	23.17 ac	15.57 d	19.85 de
	Genex	18.33 d	17.43f	18.2e	18.43 df	0e	22.93a b	23.27 ab	22.97 ac	15.27 d	19.6d e
H6gp+sd	Italian	19.93 bd	21.17b e	21.77 bc	21.97 bc	21.07 c	19.73a bc	0c	27.17 a	26.43 a	22.4a c
	Modes to	17.73 d	18.81d f	18.9d e	18.57 df	18.37 d	17.37a c	0c	23.37 ac	22.87 ac	19.5d e
	Genex	18.3d	18.77d f	18.67 de	18.6d f	18.17 d	18.1ac	0c	23.4a c	22.3a c	19.54 de
H8gp+sd	Italian	21.33 ab	21.87b c	22.23 bc	20.33 ce	20.53 c	20ac	20.43 ab	21.03 ac	26.33 a	21.57 cd
	Modes to	18.57 d	17.67f	17.9e	17.43 f	17.57 d	11.83b c	18.83 b	19.37 bc	23.37 ac	18.06 e
	Genex	18.77 cd	19df	17.8e	19.2d f	17.73 d	18.07a c	17.7b	18.4c	23.3a c	18.89 e

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed ; H = harvest .

5. Protein content

Harvest frequencies

Four harvest green pod treatment displayed the highest protein content (28.65) of green seeds (table, 18). It exceeded continuous harvest by 34.7%. Dry pod harvest came next as it bypassed continuous harvest by 32.68%, followed by six harvest treatment which exceeded continuous harvest by 30.37%. The fourth treatment was eight harvest which exceeded the continuous harvest by 22.7a%. These results were in accordance with those obtained by Rachie (1979). Dry cowpea seeds are rich in protein and 100g dry seeds contain 22.8 g protein and fresh green seeds contain 3.3g (Watt and Merrill, 1963). Even cowpea leaves were found to contain 29 to 43% protein on dry basis (Nielsen *et al.*, 1994). Modesto source appeared to possess the highest protein content for both dry seeds and green matured seeds (26.73%). However, Genex showed the lowest protein content of seeds 26.07%. Dry pod harvest of Modesto source manifested the highest seed protein content (31.06%), which was significantly exceeded other sources harvested as continuous green pod harvests, and eight harvests. The worst treatment was Genex plants harvested continuously 19.76%.

Table (18) The effects of harvesting frequencies on protein percentage in green and dry seeds (%) of Ramshorn cowpea cultivar obtained from three varying sources*						
SeedsSource	Hds	Hgp	H4gp+sd	H6gp+sd	H8gp+sd	means
Italian	26.96ac	21.63de	29.8ab	27.77ab	25.75bd	26.38a
Modesto	31.06a	22.43ce	27.55ac	26.55ad	26.07ad	26.73a
Genex	26.64ad	19.76e	28.6ab	28.87ab	26.49ad	26.07a
means	28.22a	21.27b	28.65a	27.73a	26.1a	

*Hgp=Harvesting green pod ;Hds=Harvesting dry seeds; H4gp+sd= Harvesting green pods four tims and the rest were left for dry seed; H6gp+sd= Harvesting green pods six tims and the rest were left for dry seed; H8gp+sd= Harvesting green pods eight tims and the rest were left for dry seed

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