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Optimization of spacing and mother plant nutrition on growth potential of parental lines of maize hybrid MAH 14-5

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Abstract
A study was conducted at National Seed Project, University of Agricultural Sciences, GKVK, Bengaluru during 2017-2018 to evaluate the Influence planting geometry and mother plant nutrition on seed yield and quality of parental lines Optimization of spacing and mother plant nutrition on growth potential of parental lines of maize hybrid MAH 14-5 (Male: CML-451 and female: CAL-1443) of maize hybrid MAH 14-5. The maize inbred lines were supplied with four fertilizer doses *viz.*, F_1-112.5:70:50 NPKha^{-1} + 10 kg $ZnSo_4$, F_2-150:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$, F_3-187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$, F_4-225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$ and at four different spacing *viz.*, S_1- 30×20 cm, S_2- 45×20 cm, S_3-60×20 cm, S_4-60×30 cm.

Among the interactions highest cob length in male observed in S_4F_3 (13.3 cm), cob diameter S_4F_3 (13.3 cm), number of rows per cob S_2F_4 (13.7), number of seeds per cob S_3F_2 (111.3), rind weight per cob S_2F_2 (111.3 gm), seed yield per plot S_2F_3 (2.92 kg/plot) seed yield per hectare in S_2F_2 (32.89 q/hac), graded seed yield S_2F_3 (29.45 q/hac), seed recovery percentage S_2F_2 (91.80%).whereas in case of female highest cob length was observed in S_4F_3 (14.2 cm), cob diameter S_2F_3 (13.4 cm), number of rows per cob S_1F_1 (16.7 cm), number of seeds per cob S_3F_2 (95.3), rind weight per cob S_3F_2 (95.3 gm), seed yield per plot S_2F_3 (2.37 kg/plot), seed yield per hectare in S_2F_3 (28.54 q/hac), graded seed yield S_2F_3 (29.43 q/hac), seed recovery S_4F_1 (93.09%). In male, the lowest cob length was observed in S_2F_1 (11.0 cm), cob diameter S_4F_1 (11.9 cm), number of rows per cob S_1F_2 (13.4), number of seeds per cob S_3F_2 (82.0), rind weight per cob S_2F_2 (82 gm), seed yield per plot S_2F_3 (2.01 kg/plot) seed yield per hectare in S_2F_2 (20.67 q/hac), graded seed yield S_2F_3 (19.05 q/hac), seed recovery percentage S_2F_2 (85.51%). Whereas in case of female lowest cob length was observed in S_2F_1 (11.0 cm), cob diameter S_4F_1 (11.9 cm), number of rows per cob S_1F_2 (13.4 cm), number of seeds per cob S_1F_1 (13.7), rind weight per cob S_1F_1 (32.7 gm), seed yield per plot S_4F_1 (0.81 kg/plot), seed yield per hectare in S_4F_1 (12.20 q/hac), graded seed yield S_4F_1 (11.58 q/hac), seed recovery S_3F_1 (85.51%).

Keywords: Parental lines, number of rows per cob, Number of seeds per cob, Seed yield per hactare, graded seed yield per hactare, seed recovery percentage

Introduction
Maize (*Zea mays* L.; 2n = 20) belongs to family *Poaceae* is one of the most important and versatile cereal crop, next to wheat and rice. Being a C4 plant, it is physiologically more efficient and has higher yield potential and wider adaptability over a range of environmental conditions. Maize has been an important cereal because of its great production potential and adaptability under wide range of environments. Maize occupies an important role in Indian economy, like rice, wheat and millets. Besides being a important source of food for human being, it is also used for feeding cattle, poultry and industries for the production of starch, syrup, alcohol, acetic acid, lactic acid etc.

Planting geometry is one of the important aspect in economising the inbred lines and hybrid seed production programme in comparision with the normal grain production. Planting densities have a various effect on seed yield and quality of crop. There are many factors which are responsible for lower seed yield and inadequate quality of seeds and lack of balanced nutrition. Maize is nutrient exhaustive crop and to improve the robustness of plant to get higher yield we need to improve the nutrition of mother plant by applying the optimum level of fertilizer and parental line of hybrids are shy in seed production. Since parental lines of hybrid are isogenic lines shows week in morphologically and physically results in lower seed yield and quality.

Micronutrient deficiencies have major effect on the leaves of maize during the development.

For example, zinc defiencies leads broad band of yellowing tissue on one side or both sides of the leaf midrib, symptoms will be seen within the first two weeks after sowing, it can overcome by seed treatment with micronutrients. Zinc nutrients are widely used to enhance the yield. Foliar supply of zinc sulphates boosts the uptake and accumulation of nitrogen and finally increases the maize grain yield and also improves starch contents of forage maize (Grzebisz *et al*., 2008) [4].

The new hybrid MAH 14-5 with parentage of CAL 1443 female parent and CML 451 male parent has a vital importance behind it. First and foremost reason lies in initiating region specific and need specific research. This was a public sector hybrid which has been released at recent past and performed well at farmer's fields of Karnataka assuring greater yield. As this hybrid is having good demand among farmers it is a time to make available genetically pure, high yielding quality seeds to assure farmers with promised yield potential of hybrid and its parents. Hence, it needs standardization of seed production techniques Keeping in view the study was conducted to improve the seed yield of parental line of Maize hybrid MAH 14-5.

Material and Methods

The present field experiment on Standardization of seed production technologies of parental lines of newly released maize (*Zea mays* L.) hybrid MAH 14-5 was carried out in the Department of Seed Science and Technology, GKVK and National Seed Project, University of Agricultural Sciences, Bengaluru, from 2017-18 (winter season). The details of the materials used and methods adopted during the course of study are described below.

Experimental details

- No. of lines: Two parent lines (Maize)- Male- CML 451,Female- CAL 1443
- Plot size: 3.0×3.0 m^2, RCBD design
- Total no. of treatments:16×3= 48

Treatment details

Factors: Planting Geometry

a) Spacing's

S_1: 30×20 cm
S_2: 45×20 cm
S_3: 60×20 cm
S_4: 60×30 cm

b) Nutritional levels

F_1: 112.5:70:50 NPKha^{-1}+ 10 kg $ZnSo_4$
F_2: 150:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
F_3: 187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
F_4: 225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$

Treatment combinations: (4 × 4 × 3= 48)

S_1 F_1: 30×20 cm+112.5:70:50NPKha^{-1}+ 10 kg $ZnSo_4$
S_1 F_2: 30×20 cm+ 150:70:50 NPK ha^{-1}+ 10 kg ZnSo
S_1 F_3: 30×20 cm+ 187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_1 F_4: 30×20 cm+ 225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_2 F_1: 45×20 cm + 112.5:70:50NPKha^{-1}+ 10 kg $ZnSo_4$
S_2 F_2: 45×20 cm+ 150:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_2 F_3: 45×20 cm+ 187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_2 F_4: 45×20 cm+ 225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_3 F_1: 60×20 cm+ 112.5:70:50NPKha^{-1}+ 10 kg $ZnSo_4$
S_3 F_2: 60×20 cm+ 150:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_3 F_3: 60×20 cm+ 187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_3 F_4: 60×20 cm+ 225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_4 F_1: 60×30 cm+ 112.5:70:50NPKha^{-1}+ 10 kg $ZnSo_4$
S_4 F_2: 60×30 cm+ 150:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_4 F_3: 60×30 cm+ 187:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$
S_4 F_4: 60×30 cm+ 225:70:50 NPK ha^{-1}+ 10 kg $ZnSo_4$

Cob length (cm)

The cob length was observed from the base of the cob to tip of the cob by using scale and mean of five cobs was recorded and expressed in centimetre.

Cob diameter (cm)

Cob diameter was measured by using slide calipers at the base, middle and top of five cobs and mean diameter of cob was expressed in centimetre.

Number of rows per cob

The number of rows per cob was counted from each of five cobs and average was expressed as number of rows per cob.

Number of seeds per cob

The number of seeds per cob was counted from each of five cobs individually and average was expressed as number of seeds per cob.

Seed yield (kg plot^{-1})

From all the plants in net plot area of each treatment and replications, the cobs were taken out and dried under shade till moisture content reaches 17 per cent. Then, these were dehusked and shelled followed by shade drying to reach 12 per cent moisture content. Then cleaned and processed separately to avoid admixture to maintain genetic and physical purity of the seed. Afterwards, the weight of seed per plot was recorded and expressed in kilogram (kg).

Seed yield per hectare (q ha^{-1})

The total seed yield per hectare was computed from net plot seed yield and expressed in quintal per hectare.

Graded Seed yield (qha^{-1})

The graded seed yield was obtained by sieving the bulk seed yield harvested from each plot using round sieve (5.2 mm) and the seed retained on the sieve was recorded as graded seed per plot. The graded seed yield per hectare was calculated from net plot yield and expressed in quintals per hectare.

Seed recovery (%)

Seed recovery percentage was calculated using the formula,

$$\text{Seed recovery (\%)} = \frac{\text{Graded Seed yield (q ha}^{-1}\text{)}}{\text{Bulk seed yield (q ha}^{-1}\text{)}} \text{ X } 100$$

Results and Discussion

Cob length (cm)

The results of cob length as influenced by spacing and mother plant nutrition during the seed production are presented in Table 1. The cob length differed significantly due to interaction of spacing and mother plant nutrition. In the interaction highest cob length was observed in S_4F_3 (13.3cm) in male and S_4F_3 (14.3 cm) in female Where as lowest was observed in S_1F_3 (10.5 cm) and S_2F_1 (11.0 cm) in male and female respectively. Plants supplied with more spacing and supplying more fertilizer than the recommended has lead to increased cob length which was mainly due to decrease in competition between the plants for spacing and as parental lines are weaker in performance supplying more nitrogen than recommended had lead to boosting the reproductive growth of the plants leading to increased length of the cob.

Cob diameter (cm)

With the effect of spacing and mother plant nutrition interaction a significant difference was observed. The highest cob diameter was found in S_4F_3 (13.3 cm) and S_2F_3 (13.4 cm) in male and female respectively which was on par with the S_2F_2 (13.3 cm) in male and S_4F_3 (13 cm) in female. Whereas lowest cob diameter was recorded in S_4F_1 (11.2 cm) in male and S_4F_1 (11.9 cm) in female. Increase in cob diameter with combined application of Zn as soil application and foliar spray might have been the result of increase in the availability of Zn due to seed priming and direct absorption of the Zn by the foliar spray. The proper supply of Zn increased the uptake of N during the grain formation stage and ultimately improved the yield component of maize (Siddiqui *et al.*, 2009 in rice) [9]. Positive effect on the uptake of nitrogen during the milking and grain formation stage has also been found with the early stage Zn application (Grzebisz *et al*., 2008 in maize) [4].

Number of rows per cob

Interaction of spacing and mother plant nutrition on number of rows per cob has showed the non significant difference between treatments. Among the interaction the treatment like S_1F_1 (13.9) and S_2F_4 (16.7) showed highest number of rows per cob of male and female respectively. Whereas, the lowest cob weight was noticed in S_3F_4 (12.7) in male and S_1 F_2 (13.4) in female. Probably at the time formation of number of rows per cob was not competition between physiological sink for uptake of resources. The number of seed rows per cob controlled by genetically controlled factors and uninfluenced by inputs and environmental conditions; in other words, in different environmental conditions, the number of seeds rows per cob had an almost constant rate (Ghaderi and Majidian, 2003). The similar results were also reported by Himayatullah and Qasim (2005) [5] in maize,

Number of seeds per cob

The outcome pertaining to number of seeds per row as influenced by spacing and mother plant nutrition of parental lines are presented in Table 2.

The number of seeds per cob differed non significantly among treatments. Among the interaction the treatment like S_2F_2 (111.3) and S_2F_4 (95.3) followed by S_3F_2 (108) and S_2F_3 (79.7) showed highest number of seeds per of male and female respectively. Whereas, the lowest number of seeds per cob was noticed in S_3F_4 (12.7) in male and S_1 F_2 (13.4) in female.

The increase in number of seeds / row may be due to the effect of nitrogen and zinc on enhancing the physiological functions of the crop, like photosynthesis and translocation of plant nutrients from source to sink. These results are in line with the previous findings of Siddarudh (2013) [8] in maize and Ehsanullah *et al*. (2015) [2] in maize confirmed these results.

Rind weight per cob (g)

Interaction of spacing and mother plant nutrition on rind weight per cob has showed the significant difference between treatments. Among the interaction the treatment like S_2F_2 (111.3 gm) and S_3F_2 (95.3) showed highest rind weight per cob of male and female respectively. Whereas, the lowest rind weight per cob was noticed in S_3F_1 (82 gm) in male and S_1 F_1 (32.7 gm) in female. Supplying maize crop with proper spacing and mother plant nutrition has lead to increased cob size which in turn leads to increased rind size and rind weight per cob.

Seed yield per plot (kg)

The abstracts pertaining to seed yield per plot as influenced by spacing and mother plant nutrition are presented in Table 2. Among the treatments significant difference were observed for seed yield per plot (kg). Significantly highest seed yield (2.92 kg / plot) was recorded in S_3F_2 and it was on par with S_3F_3 (2.87 kg / plot) in male and Significantly highest seed yield (2.37 kg / plot) was recorded in S_2F_3 and it was on par with S_3F_3 (2.24 kg / plot) in female and the lowest seed yield was observed in S_3F_1 (2.01 kg / plot) and S_4F_1 (0.81 kg / plot) in male and female respectively.

Maize plants receiving an optimal extra nitrogen and zinc supply significantly increased seed yield. This specific plants behavior can be explained by enhanced leaf longevity, as induced by an extra N uptake These results are in accordance with Mohsin *et al*. (2014) in maize confirmed these results.

Seed yield per hectare (q ha^{-1})

The reports pertaining to seed yield per plot as influenced by spacing and mother plant nutrition are presented in Table 3.Among the treatments significant difference were observed for seed yield quintal per hectare. Significantly highest seed yield (32.89 q ha^{-1}) was recorded in S_2F_2 and it was on par with S_2F_3 (32.46 q ha^{-1}) in male, (38.54 q ha^{-1}) was recorded in S_2F_3 and it was on par with S_2F_2 (27.90 q ha^{-1}) in female and the lowest seed yield quintal ha^{-1} was observed in S_3F_1 (20.67 q ha^{-1}) and S_4F_1 (12.20 q ha^{-1}) in male and female respectively.

Increased seed yield per hectare might be due to the higher physicochemical triggering the biosynthesis of nucleic acids, proteins and the consequential enhancement of cell division besides the enhanced metabolic activity of the plants resulting on the increased uptake of nutrients by better root system. This could have possibly accounted for improvement in crop performance and it is also due to increased final field stand, better establishment and increased growth parameters like plant height, which lead to more photosynthetic activity which in turn leads more source to sink ratio there by it helps in increased seed yields. These results also confirmed with the findings of Chandrashekhara (2014) [1] in maize and Mona E. and El-Azab (2015) [7] in maize confirmed these results.

Graded Seed yield (qha^{-1})

The results of graded Seed yield as influenced by spacing and mother plant nutrition during the seed production are presented in Table 3. Graded Seed yield differed significantly due to interaction of spacing and mother plant nutrition. In the interaction highest graded Seed yield was observed in S_2F_3 (29.45 q ha^{-1}) in male and S_2F_3 (29.43 q ha^{-1}) in female where as lowest was observed in S_3F_1 (19.05 q ha^{-1}) and S_4F_1 (11.58 cm) in male and female respectively. Plants supplied with more spacing and supplying more fertilizer than the recommended has lead to increase Seed yield which was mainly due to decrease in competition between the plants for spacing and as parental lines are weaker in performance supplying more nitrogen than recommended had lead to boosting the reproductive growth of the plants.

Seed recovery (%)

The reports pertaining to seed recovery as influenced by spacing and mother plant nutrition are presented in Table 3. Among the treatments significant difference were observed for seed recovery. Significantly highest seed recovery percentage (91.80%) was recorded in S_2F_2 and it was on par with S_1F_4 (91.34%) in male, (93.09%) was recorded in S_4F_1 and it was on par with S_3F_3 (91.61%) in female and the lowest seed recovery percentage was observed in S_3F_1 (85.51%) and S_3F_1 (85.51%) in male and female respectively. The seed recovery percentage was mainly dependent on the bulk seed yield and graded seed yield per hectare plants supplied with lesser spacing and extra nitrogen supply had lead to increased seed yield and also that treatment showed higher seed recovery percentage when compared with the other treatments.

Table 1: Effect of spacing (S) and fertilizer (F) on cob length, cob diameter and no. of rows per cob of parental lines of maize hybrid MAH-14-5.

Treatments	Cob length (cm)		Cob diameter(cm)		no. of rows per cob (no.)	
Spacing (cm)	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
S1 (30×20)	11.3	12.7	4.2	4.2	13.4	14.8
S2 (45×20)	12.1	12.3	4.2	4.3	13.4	13.2
S3 (60×20)	11.4	12.4	4.1	4.2	13.0	14.9
S4 (60×30)	12.2	13.2	4.1	4.1	13.1	14.5
S.Em±	0.2	0.2	0.4	0.4	0.2	0.4
CD (P=0.05)	0.7	0.6	1.2	NS	NS	NS
Fertilizer (NPKha^{-1}+ $ZnSo_4$)	Male	Female	Male	Female	Male	Female
F1(112.5:70:50+10)	11.3	12.4	4.0	4.1	13.2	14.3
F2 (150:70:50 + 10)	11.9	12.7	4.2	4.3	13.3	14.3
F3 (187:70:50 + 10)	12.2	12.8	4.3	4.3	13.2	14.6
F4 (225:70:50 + 10)	11.5	12.7	4.1	4.2	13.1	14.2
S.Em±	0.2	0.2	0.39	0.4	0.2	0.4
CD (P=0.05)	0.7	0.6	NS	NS	NS	NS
Interaction	Male	Female	Male	Female	Male	Female
S1 F1	11.0	12.3	12.1	12.5	13.5	13.9
S1 F2	12.4	13.5	12.6	12.8	13.3	13.4
S1 F3	10.5	12.1	13.0	12.7	13.7	14.6
S1 F4	11.2	12.8	12.3	12.7	12.9	14.5
S2 F1	11.9	11.0	12.1	12.5	13.6	10.5
S2 F2	12.6	12.0	13.0	12.8	13.2	13.8
S2 F3	12.6	13.3	12.8	13.4	13.2	14.6
S2 F4	11.3	12.9	12.2	12.6	13.7	16.7
S3 F1	10.6	13.0	12.0	12.0	12.8	16.2
S3 F2	11.4	13.0	12.6	12.6	13.5	14.7
S3 F3	12.4	11.3	12.5	12.7	12.9	14.5
S3 F4	11.2	12.1	12.2	12.6	12.7	14.1
S4 F1	11.8	13.4	11.2	11.9	13.2	13.5
S4 F2	11.4	12.2	12.4	12.7	13.2	15.4
S4 F3	13.3	14.2	13.3	13.0	12.9	14.8
S4 F4	12.3	13.0	11.8	12.0	13.1	14.2
Diff. levels of S means at the different levels of F						
S.Em±	0.5	0.4	0.8	0.8	0.4	0.9
CD (P=0.05)	NS	1.2	NS	NS	NS	NS
CV (%)	6.64	5.72	11.15	10.81	5.0	10.31

Table 2: Effect of spacing (S) and fertilizer (F) on rind weight per cob, no. of seeds per cob and seed yield per plot of parental lines of maize hybrid MAH-14-5.

Treatments Number of DAS	rind weight per cob (g)		no. of seeds per cob (no.)		Seed yield per plot (kg)	
Spacing (cm)	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
S1 (30×20)	98.8	46.5	44.3	76.6	2.41	1.92
S2 (45×20)	101.6	68.3	44.4	76.4	2.55	2.01
S3 (60×20)	96.7	57.6	43.2	78.6	2.41	1.86
S4 (60×30)	94.2	64.6	43.5	73.1	2.23	1.62
S.Em±	1.4	1.5	3.5	10.2	0.07	0.0496
CD (P=0.05)	4.1	4.4	NS	NS	0.20	0.143
Fertilizer (NPKha^{-1}+ $ZnSo_4$)	Male	Female	Male	Female	Male	Female
F1 (112.5:70:50+10)	89.4	49.4	41.7	72.2	2.11	1.34
F2 (150:70:50 + 10)	104.5	77.5	45.2	82.2	2.53	2.19
F3 (187:70:50 + 10)	102.4	48.4	44.9	76.1	2.70	2.21
F4 (225:70:50 + 10)	94.8	61.7	43.6	74.1	2.26	1.67

S.Em±	1.4	1.5	3.47	10.2	0.07	0.05
CD (P=0.05)	4.1	4.4	NS	NS	0.20	0.14
Interaction	Male	Female	Male	Female	Male	Female
S1 F1	90.7	32.7	129.5	222.9	2.07	1.65
S1 F2	101.3	65.0	134.3	242.8	2.58	2.21
S1 F3	106.3	31.3	136.4	229.2	2.65	2.21
S1 F4	96.7	57.0	131.9	224.2	2.35	1.60
S2 F1	95.3	66.3	129.6	218.9	2.25	1.64
S2 F2	111.3	85.3	137.0	242.0	2.71	2.30
S2 F3	103.3	79.7	134.5	232.7	2.92	2.37
S2 F4	96.3	42.0	131.7	223.4	2.33	1.75
S3 F1	82.0	34.3	114.6	217.3	2.01	1.27
S3 F2	108.0	95.3	138.3	275.3	2.47	2.15
S3 F3	100.3	44.3	134.1	227.1	2.87	2.24
S3 F4	96.3	56.3	131.4	223.7	2.30	1.78
S4 F1	89.7	64.3	126.5	207.9	2.11	0.81
S4 F2	97.3	64.3	133.1	226.1	2.38	2.10
S4 F3	99.7	38.3	133.5	224.6	2.35	2.04
S4 F4	90.0	91.3	129.5	222.9	2.08	1.55
Diff. levels of S means at the different levels of F						
S.Em±	2.8	3.1	20.10	20.3	0.14	0.10
CD (P=0.05)	8.1	8.8	NS	NS	0.40	0.29
CV (%)	5.01	8.9	9.16	15.42	9.89	9.28

Table 3: Effect of spacing (S) and fertilizer (F) on number of Seed yield per hectare, Graded seed yield per hectare, Seed recovery percentage of parental lines of maize hybrid MAH-14-5.

Treatments	**Seed yield per hectare (QNTLS)**		**Graded seed yield per hectare (q)**		**Seed recovery (%)**	
Spacing (cm)	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
S1 (30×20)	26.81	23.88	24.29	20.87	90.70	89.65
S2 (45×20)	29.04	24.94	25.39	21.53	89.83	88.57
S3 (60×20)	25.67	22.59	23.15	19.64	88.57	88.58
S4 (60×30)	24.40	20.40	22.09	17.84	88.91	90.07
S.Em±	0.54	0.48	0.41	0.41	1.74	2.46
CD (P=0.05)	1.55	1.38	1.18	1.20	NS	NS
Fertilizer (NPKha^{-1}+ ZnSo$_4$)	Male	Female	Male	Female	Male	Female
F1 (112.5:70:50+10)	23.02	16.88	20.44	14.51	87.40	88.56
F2 (150:70:50 + 10)	28.86	26.64	25.46	23.59	90.98	90.21
F3 (187:70:50 + 10)	28.86	26.91	26.53	23.99	90.42	90.22
F4 (225:70:50 + 10)	25.18	21.38	22.49	17.78	89.22	87.87
S.Em±	0.54	0.48	0.41	0.41	1.74	2.46
CD (P=0.05)	1.55	1.38	1.18	1.20	NS	NS
Interaction	Male	Female	Male	Female	Male	Female
S1 F1	23.06	20.05	20.00	17.23	86.92	90.34
S1 F2	28.65	26.87	26.35	23.77	92.00	89.71
S1 F3	29.43	27.12	27.13	24.02	92.57	91.33
S1 F4	26.09	21.48	23.66	18.44	91.32	87.21
S2 F1	24.98	19.95	22.04	16.90	88.72	86.76
S2 F2	32.89	27.90	27.25	24.87	90.80	90.32
S2 F3	32.46	28.54	29.45	25.96	91.45	88.72
S2 F4	25.85	23.36	22.82	18.39	88.36	88.48
S3 F1	20.67	15.31	19.06	12.34	85.51	84.05
S3 F2	27.43	26.26	24.40	23.33	90.74	91.28
S3 F3	29.07	27.24	26.45	24.31	89.01	91.61
S3 F4	25.52	21.55	22.70	18.60	89.01	87.38
S4 F1	23.38	12.20	20.64	11.58	88.45	93.09
S4 F2	26.47	25.53	23.84	22.39	90.38	89.54
S4 F3	24.47	24.75	23.10	21.68	88.64	89.24
S4 F4	23.28	19.13	20.79	15.70	88.18	88.40
Diff. levels of S means at the different levels of F						
S.Em±	1.07	0.95	0.82	0.83	3.48	4.93
CD (P=0.05)	3.09	2.76	2.37	2.39	10.04	14.23
CV (%)	7.01	7.20	6.00	7.19	NS	NS

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