RNI No. : UPENG/2006/18277

Print ISSN : 0973-6417
Online ISSN : 2454-6003

Progressive Research

An International Journal

VOLUME - 10 SPECIAL ISSUE (Part-II) YEAR - 2015

SOCIETY FOR SCIENTIFIC DEVELOPMENT IN AGRICULTURE AND TECHNOLOGY
MEERUT (U.P.) INDIA
Website : www.ssdatmeerut.com

PROGRESSIVE RESEARCH – AN INTERNATIONAL JOURNAL

Volume 10 (Special Part-II) Year 2015

CONTENTS

RESEARCH PAPERS

Progressive Research – An International Journal
Print ISSN : 0973-6417, Online ISSN : 2454-6003
Volume 10 (Special-II) : 995-997, (2015)

Society for Scientific Development
in Agriculture and Technology
Meerut (U.P.) INDIA

INFLUENCE OF SEEDLING AGE ON THE GROWTH, YIELD ATTRIBUTES AND YIELD OF TRANSPLANTED BARNYARD MILLET (*Echninochloa frumentacea*) UNDER IRRIGATED CONDITION

M. Dhananivetha[1], T. Ragavan[1], N.S. Venkataraman[2] and K. Balakrishnan[4]
[1]*Department of Agronomy,* [2]*Department of Agronomy, TNAU, Coimbatore–3*
[3]*Department of Seed Science and Technology, AC & RI, Madural-625104*

ABSTRACT

A field experiment was conducted at Central farm, Agricultural College and Research Institute, Madurai during kharif 2014 under irrigated condition to find out the influence of seedling age on growth, yield attributes and yield of barnyard millet transplanted under irrigated condition. The experiment was laid out in split plot design and replicated thrice to fulfil the statistical requirements. The treatment combinations comprising of a variety (CO (KV) 2) with new culture (ACM10145) as main plot treatments, three different ages of seedlings (14, 21 and 28 days old) as sub plot treatments were executed for the field study. The crop was fertilized with 44:22:0 kg NPK/ha. Full dose of fertilizers were applied as basal at the time of transplanting. All the crop husbandry practices were followed as per the recommendation. The results of the study revealed that, both the varieties exhibited comparable growth and grain yield. With respect to age of seedlings tried, the growth attributes viz., plant height, dry matter production and leaf area index was maximum under 21 days old seedlings when compared to 14 and 28 days old seedlings. Similarly the yield attributes of barnyard millet significantly influenced by the age of seedling and transplanting done with 21 days old seedlings recorded more number of productive tillers, higher panicle length, panicle weight and test weight which resulted in higher grain yield. Transplanting at 21 days old seedlings registered 11% and 15 % more grain yield than the seedlings transplanted at 14 and 28 days.

Key words : *Underutilized, Age of seedlings, transplanting, Dry matter production, Grain yield.*

Food from antural origin plays a significant role in the health care system of all living beings. Cereals, pulses, oilseeds, fruits and vegetables are the major source of food materials that we consume. At present increasing concern over health lead to change of diet from cereals to millets especially small millets. Small millets are important for its nutritive and cultural value and it refer to a group of small seeded cereals like finger millet, proso millet, barnyard millet, italian millet, kodo millet, little millet etc,. Barnyard millet among small millets, is a store-house of nutrition and in comparison to major food crop such as rice it has higher fiber content *i.e.,* 9.8 g/100g, fat content 5.8 g/100g, calcium 14 mg/100g, iron content 18.6 mg/100g etc. Barnyard millet also has edible stalks which are most favoured fodder for cattle. No doubt that barnyard millet is a multi-utility crop and it forms a staple food crop for a sizeable population for our country. That is why it is important to enhance production and productivity of barnyard millet to ensure food and nutritional security. It is mostly grown as a rainfed crop and sown through broadcasted method. Now it is catching up as an irrigated crop as well as an alternate crop for command area under upland system. Transplanting increases the yield of cumbu, ragi and minor millets (Appalanaidu *et al.,* 1959). Seedling age is considered as one of the most important agricultural factor for uniform positioning of crop and it primarily contributes to the number of tillers produced per hill. Transplanting of seedling in proper age can provide appropriate ground for achieving potential production by reducing the death of seedlings. When seedlings stay for a longer period of time in the nursery beds, primary tiller buds on the lower nodes of the main culm become degenerated leading to reduced tiller production (Mobasser *et al.,* 2007). Problem besetting the attainment of even a modest yield of barnyard millet are and will continue to be numerous of which selection of variety and optimum age of seedlings are important components. Hence, an attempt was made to elicit information on optimum seedling age for transplanting barnyard millet under irrigated condition.

MATERIALS AND METHODS

Field experiment was conducted during kharif 2014 at Central farm, Agricultural College and Research Institute, Madural at 9o54' N latitude 78o54' E longitude and at an elevation of 147 m above mean sea level. The experiment was laid out in split plot design and replicated thrice to fulfil the statistical requirements. The variety CO (KV) 2 of barnyard millet, having compact panicle with brownish grey grains and ACM 10145, a pre release culture having compact short panicle were used as test crops and allotted in main plots, while age of seedlings (14, 21 and 28 days old seedlings) into sub plots. A well drained fertile soil having good irrigation facility near to the nursery plot was selected for raising nursery. Variety and pre-release culture nursery were raised separately. Raised beds of size 3 m x 1.5 m with 30 cm irrigation cum drainage

Table-1 : Growth parameters (at active tillering), yield attributes, grain and straw yield of barnyard millet as influenced by age of seedlings.

Treatments	Plant height (cm)	No. of tillers (No.)	LAI	Dry matter production (t/ha)	No. of productive tillers (No.)	Panicle wt. (g/ panicle)	Test weight (g)	Grain yield (kg/ha)	Straw yield (t/ha)
Varieties (V)									
V_1	84.95	5.76	10.51	15.2	5.58	5.07	2.88	2058	10.12
V_2	93.74	5.93	10.91	14.9	5.74	4.93	2.98	2030	8.53
SEd	0.40	0.13	0.90	0.04	0.05	0.29	0.08	42.10	0.123
CD (P = 0.05%)	1.74	NS	NS	NS	NS	NS	NS	NS	0.253
Age of seedlings (A)									
A_1	87.58	5.42	10.87	14.3	5.58	4.94	2.85	1986	9..02
A_2	92.09	6.18	11.10	15.2	6.05	5.23	3.14	2218	9.67
A_3	88.35	5.38	10.17	13.8	5.35	4.84	2.81	1927	8.86
SEd	1.32	0.16	0.26	0.24	0.18	0.11	0.06	49.34	0.118
CD (P = 0.05%)	3.04	0.37	0.61	0.52	0.43	0.25	0.15	113.7	0.272

*Interaction effect was not significant between the variety and age of seedlings.

channel is prepared all around the beds. A well decomposed FYM @ 1 kg/m^2 was applied and incorporated into the soil. The first sowing of the variety and culture was done on 7th August and subsequent sowings were done in staggered fashion depending on the age of seedlings required.

The experimental field was prepared and demarcated into plots providing irrigation and drainage channels according to the layout plan. The seedlings were transplanted in the respective as per the treatments. The crop was fertilized with 44:22:0 kg NPK/ha as basal and raised with all the recommended package of practices. The soil of the experimental field site was clay loam and classified under Typic Hapludalf. The nutrient status of soil is low in N, medium in P and high in K with OC content of 0.2 per cent. The pH of the soil was 6.8. The observations on growth and yield attributing characters were recorded at intervals. The data collected on various parameters were analyzed statistically as per the method suggested by Gomez and Gomez (2010) to draw conclusion.

RESULT AND DISCUSSION

Growth parameters : Variety and age of seedling significantly influenced the plant height, number of tillers/plant, dry matter production and LAI. Inherent genetic nature of variety which will respond to various physical conditions imposed on them resulted in enhanced plant height resulted in increased plant height under CO (KV) 2. A similar finding in pearl millet was reported by Murungu *et al.* (2006). Transplanting of 21 days old seedlings recorded higher plant height over others due to quick recovery and establishment which favoured the crop growth. Transplanting of 14 days old seedlings recorded reduced plant height due to young roots which took longer time for establishment and in case of 28 days old seedlings due to more growth of roots while transplanting it will turn upward and it take longer time for establishment. This is in accordance with the findings of Divakaran (1967) who reported that 20-30 days old seedlings recorded the maximum growth of ragi. Number of tillers per plant was higher under 21 days old seedlings due to favourable environment created and better absorption of nutrients and moisture from the soil. While young and older seedlings recorded less number of tillers due to poor tillering activity. Similar results were reported by Singh and Battacharya (1975).

Higher dry matter production and LAI was recorded under 21 days old seedlings due to reduced damage to the roots caused during uprooting the seedlings following a rapid growth with short phyllochrons. The LAI is the best measure of the capacity of a crop for maximum dry matter production. Twenty one days old seedlings recorded the higher LAI values and the older seedlings (28 days) recorded the lower values. This might be due to younger seedlings recorded better root growth and facilitated increased cell division and cell enlargement due to increased photosynthetic rate subsequently increasing the LAI. The similar findings also reported by Shrirame *et al.* (2000). Poor growth of the plant in the case of older seedlings might have limited the leaf size and number of leaves and that may be the reason for lower LAI value in case of older seedlings. This is also in accordance with the findings of Rajendran and Ganesa raja (2014).

Yield attributes : Higher number of productive tillers were recorded under 21 days old seedlings due to more vigorous root growth, plant got better access to the nutrients and water that they require to produce tillers. The reason for reduction in tillering with overaged seedlings is attributed to the phyllochron effect. Similar findings was reported by Chandrakar *et al.* (2008) who reported that number of productive tillers were reduced with progress in age of seedlings. Panicle weight and 1000 grain weight

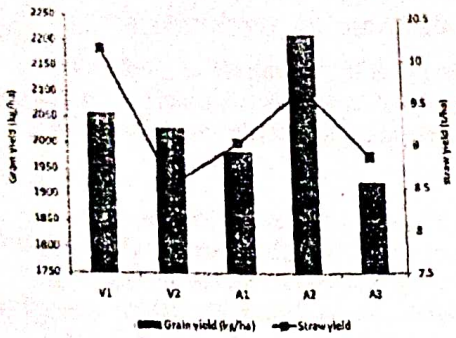

Fig.-1 : Effect of age of seedlings on grain and straw yield of barnyard millet

was recorded significantly higher under seedling age of 21 days as compared to 14 and 28 days old seedlings due to better accumulation of photosynthates during vegetative growth and their effective translocation during reproductive phase to sink (Sandhya Kanthi *et al.*, 2014).

Grain and straw yield : The grain yield of barnyard millet was significantly superior at seedlings transplanted under 21 days (21218 kg/ha) followed by 14 days (1986 kg/ha) were as, the 28 days old seedlings recorded lower grain yield of 1927 kg/ha. The better initial growth coupled with superior yield attributes (number of productive tillers, panicle weight and 1000 grain weight) might ascribed as the reason for higher grain yield. A similar finding in rice was reported by Naresh *et al.* (2014). Better initial growth with optimum utilization of resources which had a direct bearing on production of finger millet was reported by Adikant Pradhan *et al.* (2015). Reduction in grain yield to about 15 per cent was recorded under aged seedlings. Similar results in ragi by use of aged seedlings was reported by Divakaran (1967).

The straw yield is a function of crop bio mass development during the crop growth period. The data on straw yield showed that 21 days old seedlings increased the straw yield of over 14 and 28 days old seedlings. This might be due to effective utilization of resources that ultimately lead to increased plant height, number of tillers, dry matter production thereby increased straw yield in barnyard millet. Similar findings also reported by Kavitha *et al.* (2010).

CONCLUSION

Pre-release culture and the variety of barnyard millet performed equally. Further transplanting of seedlings at 21 days is better to realize higher yield than 14 or 28 days old seedlings. It can also be concluded that transplanting barnyard millet seedlings enhances the performance through production of vigorous plants and good stand of crops, more number of productive tillers, lengthier panicles and yield.

REFERENCES

1. Adikant Pradhan, A. Sao, D.P. Patel. S.K. Nagand S.C. Mukherjee (2015). Effect of estabilshment methods and nitrogen levels on finger millet (*Elusine coracana* L. Gaertn). *Ann. Agric. Res. New series. 36(1):* 107-113.
2. Appalanaidu, B. and K. S. R.K. Sankar Rao (1959). Effect of transplanting some minor millets. *Andhra agric. J., 6 :* 76-78.
3. Chandrakar, R. K., A. Kumar and N.K. Rastogi (2008). Effect of seedling age on seed yield and its quality in paddy cv. Mahamaya. *Seed res., 36(1):* 68-72.
4. Divakaran, K. (1967). Studies on age of seedlings in ragi. *Madras agric. J., 54 (9) :* 456-64
5. Gomez, K.A. and A.A. Gomez (2010). Statistical procedures for Agricultural Research. Wiley India Pvt. Ltd., New Delhi, India.
6. Kavitha, M.P., V. Ganesa raja, V.K. Paulpandi and R. Balasunbramanian (2010). Effect of age of seedlings, weed management practices and humic acid application on system of rice intensification. *Indian J. Agric. Res., 44:* 294-299.
7. Mobasser, H.R., D.B. Tari, M. Vojdani, R.S. Abadi and A. Eftekhari, 2007. Effect of seedling age and planting space on yield and yield components of rice (*Neda Variety*). *Asian J. Plant Sci., 6(2):* 438-440.
8. Murungu, F.S., P. Nyamudeza, F. T. Mugabe, I. Matimati and S. Mapfumo (2006). Effect of seedling age on transplanting shock, Growth and yield of pearl millet (*Pennisetum glaucum* L.) varieties in semi-arid Zimbabwe. *J. of Agrono., 5(2):* 205-211.
9. Naresh, D., M. Malla Reddy and D.V.V. Reddy (2014). Tiller dynamics, yield and yield attributes of rice varieties to the age of seedlings. *The Andhra Agric. J. 61(4):*740-743.
10. Puttasamy, S., S.T. Gowda and K. Krishnamurthy (1976). Determination of leaf area in pulses. *Current Res., 5(3):* 43-58.
11. Rajendran, K. and V. Ganesa raja (2014). Effect of age of seedlings on growth and yield of rice—A review. *Indian J. of advances in Plant Res., 1(5):* 62-66.
12. Sandhya Kanthi, M.A.V. Ramana, K.V. R. Murthy and V. U. Mahesh (2014). Effect of crop establishment Techniques and nutrient doses on growth, yield and economics of rice (*Oryza sativa*). *The Andhra Agric. J., 61(1):* 31-34.
13. Shrirame, M.D., H.J. Rajgire and A.H. Rajgire (2000). Effect of spacing and seedling number per hill on growth and yield of rice hybrids under lowland condition. *J. Soils and Crop. 10:* 109-113.
14. Singh, D.N. and A. Bhattacharya (1975). Effect of age of seedlings at transplanting on growth and yield of rice varieties. *Expt. Agric., 11(1):* 65-74.

Progressive Research – An International Journal
Print ISSN : 0973-6417, Online ISSN : 2454-6003
Volume 10 (Special-II) : 776-778, (2015)

Society for Scientific Development
in Agriculture and Technology
Meerut (U.P.) INDIA

EFFECT OF SPACING ON THE GROWTH AND YIELD OF TRANSPLANTED BARNYARD MILLET (*Echninochloa frumentacea*) UNDER IRRIGATED CONDITION

M. Dhananivetha[1], T. Ragavan[2], N.S. Venkataraman[3] and C. Vanniarajan[4]
[1]Ph.D. Scholar, [2]Professor, Department of Agronomy, [4]Professor and Head, Department of Plant Breeding and Genetics, AC & RI, Madurai-625104 Professor[3], Department of Agronomy, TNAU, Coimbatore-3

ABSTRACT

A field experiment was conducted at Central farm, Agricultural College and Research Institute, Madurai during *kharif* 2014 under irrigated condition to find out the effect of spacing on transplanted barnyard millet. The experiment was laid out in split plot design and replicated thrice. The treatment combinations comprising of a variety (CO (KV) 2) with new culture (ACM10145) as main plot treatments, six different spacing were adopted as sub plot treatments were executed for the field study. The crop was fertilized with 44:22:0 kg NPK/ha. Full dose of fertilizers were applied as basal at the time of transplanting. All the crop husbandry practices were followed as per the recommendation. The results of the study revealed that, both the varieties exhibited comparable growth and grain yield. With respect to spacing adopted, the growth attributes *viz.*, plant height, dry matter production and leaf area index was maximum under 25 x 10 cm and 30 x 10 cm. Wider spacing of 45 x 20 cm recorded higher yield attributes *viz.*, number of productive tillers, higher panicle length, panicle weight and test weight. Higher grain and straw yield was recorded under lower spacing of 25 x 10 cm and 30 x 10 cm due to increased plant population.

Keywords : *Underutilized barnyard millet, spacing, Dry matter production, Grain yield*

Food from antural origin plays a significant role in the health care system of all living beings. Cereals, pulses, oilseeds, fruits and vegetables are the major source of food materials that we consume. At present increasing concern over health lead to change of diet from cereals to millets especially small millets. Small millets are important for its nutritive and cultural value and it refer to a group of small seeded cereals like finger millet, proso millet, barnyard millet, italian millet, kodo millet, little millet etc,. Barnyard millet among small millets, is a store-house of nutrition and in comparison to major food crop such as rice it has higher fiber content i.e., 9.8 g/100g, fat content 5.8 g/100g, calcium 14 mg/100g, iron content 18.6 mg/100g etc. Barnyard millet also has edible stalks which are most favoured fodder for cattle. No doubt that barnyard millet is a multi-utility crop and it forms a staple food crop for a sizeable population for our country. That is why it is important to enhance production and productivity of barnyard millet to ensure food and nutritional security. It is mostly grown as a rainfed crop and sown through broadcasted method. Now it is catching up as an irrigated crop as well as an alternate crop for command area under upland system. Transplanting increases the yield of cumbu, ragi and minor millets (Appalanaidu *et al.*, 1959). Information regarding agronomy and genetics of millets is scarce. At present production of millets is based on farmers practice. Since improved agronomic practices such as optimum seed rate, spacing, nutrient management and weed management are lacking for the crop. Among the cultivation practices selection of variety and adoption of spacing are important components. Since no research attempts have been conducted in the target area on optimum spacing, an attempt was made to elicit information on optimum spacing for transplanting barnyard millet under irrigated condition.

MATERIALS AND METHODS

Field experiment was conducted during *kharif* 2014 at Central farm, Agricultural College and Research Institute, Madurai at 9°54' N latitude 78°54' E longitude and at an elevation of 147 m above mean sea level. The experiment was laid out in split plot design and replicated thrice to fulfil the statistical requirements. The variety CO (KV) 2 of barnyard millet, having compact panicle with brownish grey grains and ACM 10145, a pre release culture having compact short panicle were used as test crops and allotted in main plots, while spacing (25x10, 25 x 20, 30x10, 30x20, 45 x10 and 45 x 20cm) into sub plots. A well drained fertile soil having good irrigation facility near to the nursery plot was selected for raising nursery. Variety and pre-release culture nursery were raised separately. Raised beds of size 3m x 1.5 m with 30 cm irrigation cum drainage channel is prepared all around the beds. A well decomposed FYM @ 1 kg/m^2 was applied and incorporated into the soil.

The experimental field was prepared and demarcated into plots providing irrigation and drainage channels according to the layout plan. The seedlings were transplanted in the respective as per the treatments. The crop was fertilized with 44:22:0 kg NPK ha^{-1} as basal and raised with all the recommended package of practices. The soil of the experimental field site was clay loam and classified under *Typic Hapludalf*. The nutrient status of soil is low in N, medium in P and high in K with OC content of 0.2 per cent. The pH of the soil was 6.8. The

Table-1 : Growth parameters (at active tillering), yield attributes, grain and straw yield of barnyard millet as influenced by spacing.

Treatments	Plant height (cm)	No. of tillers (No.)	LAI	Dry matter production (t/ha)	No. of productive tillers (No.)	Panicle wt. (g/ panicle)	Test weight (g)	Grain yield (kg/ha)	Straw yield (t/ha)
Varieties (V)									
V_1	84.95	5.76	10.51	15.2	5.58	5.07	2.88	2058	10.12
V_2	93.74	5.93	10.91	14.9	5.74	4.93	2.98	2030	8.53
SEd	0.40	0.13	0.90	0.04	0.05	0.29	0.08	42.10	0.129
CD (P = 0.05%)	1.74	NS	NS	NS	NS	NS	NS	NS	0.253
Spacing (S)									
S_1	173.6	8.01	14.69	18.0	4.85	4.45	2.81	2340	8.34
S_2	161.3	8.53	9.47	14.5	5.10	5.13	2.88	1901	10.19
S_3	171.1	8.20	13.31	17.6	5.29	4.50	2.88	2131	8.84
S_4	166.5	8.96	8.57	15.2	6.07	5.18	2.90	1942	10.13
S_5	165.3	9.16	10.56	16.8	5.98	5.09	3.00	2065	8.90
S_6	158.3	9.68	6.67	14.2	6.67	5.67	3.12	1884	9.56
SEd	3.16	0.16	0.77	0.35	0.31	0.22	0.07	83	0.39
CD (P = 0.05%)	6.34	0.33	1.54	0.71	0.62	0.45	0.14	169	0.78

*Interaction effect was not significant between the variety and spacing.

observations on growth and yield attributing characters were recorded at intervals. The data collected on various parameters were analyzed statistically as per the method suggested by Gomez and Gomez (2010) to draw conclusion.

RESULT AND DISCUSSION

Growth parameters : Variety and different spacing adopted significantly influenced the plant height, number of tillers/plant, dry matter production and LAI. Inherent genetic nature of variety which will respond to various physical conditions imposed on them resulted in enhanced plant height resulted in increased plant height under CO (KV) 2. A similar finding in pearl millet was reported by Murungu *et al.* (2006). Higher plant height was recorded under the closer spacing of 25 x 10 cm and 30 x 10 cm than wider spacing because it resulted in increased plant competition for moisture and nutrients and plants had no chance to spread but to elongate to get more light and its interception required for photosynthetic activity. Less completion between the plants resulted in reduced plant height under wider spacing. A similar finding was reported by Bhatti *et al.* (1985). Number of tillers per plant was higher under wider spacing of 45 x 20 cm due to lesser population which resulted in less competition for nutrient, moisture and light. This fact might have contributed to the increased total number of tillers per plant. This is in accordance with the findings of Rajendren (1969) who recorded higher number of tillers in finger millet under wider spacing. LAI is the best measure of the capacity of a crop for maximum dry matter production. Higher dry matter production and LAI was recorded under closer spacing of 25 x 10 cm and 30 x 10cm due to increased plant population per unit area of land. Similar results was also reported by Mehrotra *et al.* (1975).

Yield attributes : Different levels of spacing significantly influenced the productive tillers per hill. Wider spacing of 45x 20 cm and 30 x 20 cm significantly increased the number of productive tillers. This is in accordance with the findings of Tirupathy (1971). In case of closer spacing more completion between the plants resulted in lesser number of productive tillers per hill.

Panicle weight and 1000 grain weight was recorded significantly higher under the wider spacing of 45 x 20cm than closer spacing due to maximum utilization of nutrients and moisture. Similar results in finger millet was obtained by Ranganathan (1962).

Grain and straw yield : The grain yield of barnyard millet was significantly superior at closer spacing of 25 x 10 cm with a grain yield of 2340 kg/ha than wider spacing. Even though plants in wider spacing exerted minimum competition for nutrients, moisture and solar energy plant population under wider spacing was only 50% of the population under closer spacing. Increase in yield attributes under wider spacing is not able to compensate the grain yield recorded under closer spacing. Increase in intra row spacing by 10 cm along with varied inter row spacing increased the yield attributes to some extent but it did not compensate the yield produced under the recommended inter row spacing of 10 cm.

The straw yield is a function of crop bio mass development during the crop growth period. The data on straw yield showed that closer spacing of 25 x 10 cm increased the straw yield. This might be due to effective

utilization of resources that ultimately lead to increased plant height, number of tillers, dry matter production thereby increased straw yield in barnyard millet. Similar findings in ragi was reported by Kolandaiswamy (1964).

CONCLUSION

From the study it was concluded that the pre-release culture and the variety performed equally. Transplanting seedlings at closer spacing of 25 x 10 cm and 30 x 10 cm due to optimum plant population which favoured the growth of crop.

REFERENCES

1. Appalanaidu, B. and K. S. R. k. Sankar Rao. 1959. Effect of transplanting some minor millets. *Andhra agric. J., 6:* 76-78.
2. Bhatti, M. B., Dost Mohammad, Sartaj and M. I. Sultani. 1985. Effect of different inter and intra-row spacing on forage yield and quality of Elephant grass.
3. Kolandaiswamy, S. 1964. Effect of spacing and split doses of nitrogen on CO 7 ragi. *M.Sc. (Ag.) dissert. Unpublished. Univ.* Madras.
4. Mehrotra, O.N., H.K. Saxena and R.S. Ram. 1975. Leaf area Index, growth and yield of rice. *Indian J. of agron., 16(1):* 6-10.
5. Murungu, F. S., P. Nyamudeza, F. T. Mugabe, I. Matimati and S. Mapfumo. 2006. Effect of seedling age on transplanting shock, Growth and yield of pearl millet (*Pennisetum glaucum* L.) varieties in semi-arid Zimbabwe. *J. of Agrono., 5(2):* 205-211.
6. Rajendran, K. and V. Ganesa raja. 2014. Effect of age of seedlings on growth and yield of rice – A review. *Indian J. of advances in Plant Res., 1(5):* 62-66.
7. Ranganathan, A.K. 1962. Influence of spacing and manuring on the yield of irrigated ragi. *M.Sc. (Ag.) dissert. Unpublished. Tamil Nadu Agri. University.*
8. Tirupathy, R. 1971. Influence of N and plant density on yield quality and uptake of nutrients in CO 7 ragi *Unpub. M.Sc. (Ag.) Thesis. Univ.* Madras.