Morphological studies and yield performance of promising genotypes of Jatropha under *Tarai* region of Uttarakhand

M.K. NAUTIYAL, RAJANI RAWAT, BHAWESH JOSHI, LALIT JOSHI and GEETA PANDEY

Department of Genetics and Plant Breeding, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar-263 145, (U.S. Nagar, Uttarakhand)

ABSTRACT: Study to assess the morphological traits and seed yield of some of the new promising: genotypes and prevalent genotypes of Jatropha, a field experiment was conducted at Medicinal Research and Development Centre (MRDC) of G. B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar, Uttarakhand. The trial was replicated thrice in Randomized Complete Block Design (RBD) with nine new promising genotypes. *J. curcas* has a wide range of adaptation, and is able to endure drought and barren; as its root system is well developed, it can grow on the barren wasteland (cobbly soil, coarse soil, and limestone open ground etc.). *Jatropha curcas* L. grows as a large shrub or small tree and it has great potential as energy crop. Jatropha seed oil, nonedible oil and its methyl ester has been chosen to find out its suitability for use as fuel oil. Oil content in the seed is about 30-40%. Morphological studies and yield observation of jatropha genotypes were recorded and revealed that out of nine genotypes the new genotype ('Pant Jatropha H-1') gave the best performance on the basis of seed yield per plant and maximum 100 grain weight.

Key words: Cobbly soil, Jatropha *(J. curcas),* Moghal Erand, Ratanjot.

Jatropha curcas also known as Ratanjot, Van Erand or Moghal Erand, Jamalghota, Jangli arandi, Parvat arandi, lanka ber etc. *Jatropha (J. curcas)* is a genus of flowering plants belongs to the family Euphorbiaceae. The name is derived from the Greek words *jatros*, meaning "physician" and *trophe*, meaning "nutrition" hence the common name physic nut. It contains approximately 170 species of succulent plants, shrubs and trees (some are deciduous, like *Jatropha curcas*). Over the last 2 to 3 decade in the plant species *Jatropha curcas* has again generated the interest of many scientists in the field of bio-energy. Many excellent characteristics, including high yield ability, high oil content, resistance to drought and good quality of plant oil, have been attributed to this plant. Use of Jatropha seeds for Biodiesel process offers great hope of being developed. Jatropha is being considered among the profitable crop. It can be cultivated in stony, gradient sandy oil and in the land of tiny deepness. The oil extracted from the jatropha seeds is non-edible and is used in making in commercial product like soaps, cosmetics, colors, candles and wool. The oil cake is used in making plastics and synthetic fibers. Jatropha oil is rich in medicinal properties and is used in treatment of skin-diseases, paralysis, toothache, stomachache etc. The latex, oil, twigs, wood and leaves are used externally for healing wounds, to stop bleeding and to treat rheumatism and skin diseases, other medicinal uses are as a laxative, cough remedy, antidote for poisoning, relief for tooth aches to strengthen gums. Its mixture with cow urine is used as a Bio-Insecticide. Biodiesel is an alternate fuel for diesel engine which is a domestic, renewable fuel for diesel engine derived from natural oil like Jatropha oil. Biodiesel has an energy content of about 12% less than petroleum-based diesel fuel on a mass basis. It has a higher molecular weight, viscosity, density, and flash point than diesel fuel. *Jatropha curcas* is unusual among tree crops, is a renewable non-edible plant. Jatropha oil has similar properties as diesel but some properties such as kinematic viscosity, solidifying point, flash point and ignition point is very high.

MATERIALS AND METHODS

Field experiment was conducted in Medicinal Research and Development Centre (MRDC) of G. B. Pant University of Agriculture and Technology, Pantnagar, U. S. Nagar, Uttarakhand. Under the experiment nine genotypes including eight promising *Jatropha curcas* L. genotypes were selected on the basis of performance in grain yield per plant, oil content and 100 grain weight etc along with developed new genotype *i.e.* 'Pant Jatropha H-1' were evaluated. Data were taken on three years old genotype in which pruning was exercised on third year in the February end. Yield was taken in the end of November. These genotypes were

evaluated in Randomized Block Design (RBD) using three replications with plant spacing of 2×2 meter. The recommended agronomical and plant protection practices were adopted for raising a healthy crop. The morphological data for which genotypes were evaluated are, plant height, height from color zone to pruned area, primary branches, secondary branches, collar diameter, 100 grain weight, seed yield per plant, seed yield per hectare, etc. the experiment was planted in 28 February 2011. Pruning was done in the first week of March 2014, harvesting was done in December 2014.

RESULTS AND DISCUSSION

Table 1 clearly indicate that parameters such as plant height, plant height from collar region to pruned area, collar diameter, primary and secondary branches, seed yield per plant, yield per hectare and 100 grain weight were significantly different in different jatropha genotypes. Among nine genotypes the plant height was found maximum 'PKVJ- DHW 1' X 'IGAU Surzuja' *i.e.* 355cm and minimum was recorded in 'Pant Jatropha H-1' *i.e.* 285cm and plant height from collar zone to pruned area was highest in a new genotype which is a cross between 'PKVJ- DHW' × 'TNMC-3' *i.e* 131.70cm and minimum in a 'Pant Jatropha H-1' *i.e.* 101.66cm. However, from statistically point of view, the plant height from collar zone to pruned area of 'Pant Jatropha H-1' was not much different from those of IGAU Raipur (103.83 cm) and INMC-4 (104.13cm). The other plant parameter viz. collar diameter and primary branches were recorded maximum in 'PKVJ- DHW' × 'TNMC-3'. The collar diameter in genotypes was ranged from 31.36cm ('PKVJ-DHW') to 52.98cm ('PKVJ- DHW' × 'TNMC-3') and primary branches was varied from 4.91 ('TNMC-4') to 8.08 ('PKVJ- DHW' × 'TNMC-3').

Secondary branches of nine genotypes were also observed and found that the maximum secondary branches were recorded in genotype 'Pant Jatropha H-1' which was 34.18. these results are in concurrence to the findings of Biabani *et al.* (2012) who reported significant variations were among the populations with regard to number of secondary branches was recorded in Malaysia (4.4) and Indonesia (6.4) for first and second year respectively. On the other hand, significant variation observed among the populations for plant height, number of secondary branches. Our result had same trend with Rao *et al.* (2008), Ginwal *et al.* (2005) and Rafii *et al.* (2012). Plant height, number of secondary branches and number of tertiary branches are important traits that could be considered as major selection index.

Seed yield per plant was highest in 'Pant Jatropha H-1' which recorded 2.82 kg per plant and was followed by 'PKVJ- DHW' × 'TNMC-3' with value of 1.54kg. Minimum seed yield per plant was seen in 'Sagar' (SFRI, Jabalpur) (0.45kg) followed by 'PKVJ-DHW-1' (0.46kg). Data on average seed yield per hectare have been presented in Table-2. Table clearly shows that new genotypes significantly varied from each other in their final yield. Out of nine promising genotypes the highest seed yield (71.00q/ha) of freshly harvested properly dried seed was obtained in hybrid 'Pant Jatropha H-1', followed by 'PKVJ- DHW' × 'TNMC-3' (38.50q/ha), IGAU Raipur (36.83q/ha) etc. Data depicted Table-2 clearly indicates

Table 1: Average Plant Height, Plant Height from collar region to pruned area, Collar Diameter, Primary and Secondary Branches in different promising genotypes of Jatropha.

Promising genotypes	Plant Height (cm)	Plant Height from collar region to pruned area (cm)	Collar Diameter (cm)	Primary Branches	Secondary Branches
IGAU Raipur	339	103.83	45.60	5.75	28.91
TNMC - 4	345	104.13	34.70	4.91	15.78
Sager (SFRI. Jabalpur)	324	111.53	33.53	5.00	21.45
Pant J. Sel - 2	335	123.73	33.73	6.11	22.83
PKVJ- DHW - 1	322	125.58	31.36	5.83	19.21
PKVJ- DHW - 1 X IGAU Bilaspur	345	129.25	37.50	7.45	22.20
PKVJ- DHW - 1 X IGAU - Surzuja	355	130.66	37.50	7.50	20.11
PKVJ- DHW - 1 X TNMC - 3	361	131.70	52.98	8.08	32.98
Pant jatropha H-1	285	101.66	43.85	7.41	34.18
Gm	334	118.01	38.97	6.41	24.18
Sem	.27	0.82	0.69	0.23	0.38
cd at 1%	.11	3.40	2.86	0.96	1.57
cd at 5%	.82	2.47	2.07	0.70	1.14
cv	1.41	1.21	3.08	6.27	2.72

Table 2: Seed yield per plant, Average seed yield per hectare 100 seed weight in different promising genotype of Jatropha

Promising genotypes	Seed yield per plant (Kg)	Average seed yield (q/ha)	100 seed wight
IGAU Raipur	1.47	36.83	77.66
TNMC - 4	0.74	18.50	61.66
Sager (SFRI. Jabalpur)	0.45	11.41	71.66
Pant J. Sel - 2	0 .55	13.91	71.66
PKVJ- DHW - 1	0.46	11.66	75.66
PKVJ- DHW - 1 X IGAU Bilaspur	0.73	18.33	77.50
PKVJ- DHW - 1 X IGAU - Surzuja	0.56	14.08	82.00
PKVJ- DHW - 1 X TNMC - 3	1.54	38.50	83.70
Pant jatropha H-1	2.82	71.00	100.00
Gm	0.81	26.02	77.94
Sem	0.75	1.91	2.23
cd at 1%	0.31	7.91	9.23
cd at 5%	0.22	5.74	6.70
cv	16.03	12.75	4.96

that 100 seed weight of each genotype was varied from 61.66g to 100.00g. The highest 100 seed weight per plant was observed in hybrid 'Pant Jatropha H-1' *i.e.* 100g followed by 'PKVJ- DHW' × 'TNMC-3' having 100 seed weight 83.70g. Seed source variation in Jatropha with regards to their morphological characters could be because of fact that the species grows over a wide range of temperature, rainfall and soil type. Also, variations in relation to habitat have also been reported in number of tree species. Various seed sources, provenances and ecotypes of *Jatropha curcas* L. presented variation in seed morphological traits by Kaushik *et al.* (2007). These findings were also in accordance to the observation recorded by Biabani *et al.* (2012). They reported that among 11 genotypes the 100 seed weight ranged from 66.21g (Indonesia) to 76.72g (Malaysia), with a mean of 72.80g. Phenotypic variations recognized by Ghosh and Singh (2011), Kaushik *et al.* (2007) and Rao *et al.* (2008) in 100 seed weight and seed yield among *J. curcus* L. populations.

CONCLUSION

On the basis of above observations it can be concluded that the newly evolved jatropha hybrid *i.e.* 'Pant Jatropha H-1' will be helpful to increase the yield of jatropha seeds as well as the jatropha oil more than two and half times in comparison to the available promising genotypes. This genotype has got 34 % of oil which is far better to the most of the existing genotypes. Hence the use of 'Pant Jatropha H-1 on large scale can definitely contribute in increasing the seed and oil production, which will be a contributing factor for enhancing the biodiesel production.

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Received: February 27, 2015
Accepted: July 11, 2016