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Research Article

GROWTH PERFORMANCE OF AN IMPORTANT MEDICINAL FRUIT TREE: PHYLLANTHUS EMBLICA

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ABSTRACT

The present study was conducted to evaluate the growth performance of *Phyllanthus emblica* plantations raised in an abandoned fallow land of Jai Prakash University Chapra Campus during the period August 2015 to July 2017.The parameters studied were height, diameter ,height diameter ratio and tree volume of 3-year old plantations at three sites .The increase in height ranged from 4 to 25% in 2016 and 14 to 18% in 2017;diameter from 38 to 72% in 2016 and 36 to 46% in 2017;height diameter ratio 185% at one site and decreased from 53 to 56% in 2016 and in 2017decreased by 9.6 to 6.9 %;and tree volume at one site decreased by 8% and increased by two sites from 210 to 300% in 2016 and in 2017 increased by 125 to 173%.The monthly increment in height in 2015-2016 ranged from 5.53 to 8.33cm/mon and in 2016-2017 it ranged from 4.33 to 8.87cm/mon ;and diameter value ranged from 0.15 to 0.87 cm/mon in 2015-2016 and in 2016-2017 it ranged from 10.6 to 13.0 cm/mon. The annual increment in height value in 2015-2016 ranged 66.3 to 100 cm/yr and in 2016 -2017 from 52.02 to 106.4 cm/yr whereas annual increment in diameter value ranged from 1.8 to 10.4 cm/yr in 2015-2016 and 0.88 to 1.08 cm/yr in 2016-2017. This study indicated that the growth of *Phyllanthus emblica* is satisfactory in the fallow land of the present study sites.

INTRODUCTION

The disease free healthy life of human beings can be promoted by natural gifts, the medicinal plants. The *Phyllanthus emblica* is widely distributed in tropical and subtropical areas. It is used in Indian system of medicine and believed to increase defense against diseases. It is a deciduous tree and successfully grows in variable agro-climatic and soil conditions. The fruit of alma is acclaimed for its unique natural and rejuvination properties. It is abundant in deciduous forest found in the plains of U.P. Madhya Pradesh, Andhra Pradesh, Karnataka, Kerala, Tamilnadu etc.vitamin C present in amla is a complex form and also contains Ca,P,Fe, Carotene and Vitamin B complex. It is used as aperient, antibacterial, antifungal, antiviral, antioxidant, aphrodisiac, boils and spots, chelating agent in constipation, dental problems, diabetes, diarrhoea, diuretic and used in fevers, gonorrhoea, hair growth, headache, indigestion, inflammation, mouth ulcers, nausea, nose bleed, perfumery, pruritis, respiratory problems, scurvy, skin sores and wounds, skin whitening, sore eyes, tonic, vaginal complaints, water purification, worms etc. The dried fruit, the nut or seed, leaves, root,bark and flowers of frequently used. It belongs to the family Euphorbiaceae. Ghosal *et al* (1996) have reported that fruits of amla contains emblicanin-A: 27% emblicanin-B: 23%, punigluconin: 8%, pedunculagin: 14%, gallo-ellagitannoids: 18% and rutin: 10%. Amla tree is commonly used as food, fodder, fuelwood, essential oil, medicine, triphala, soil improver etc. Terrestrial plants allocate carbon to stems to support their photosynthetic tissues and elevate their leaves above competitors and into the sun- light.To understand the structure and dynamics of forests and the competitive in interactions among the tree species in them, one needs to understand the relationships among bole diameter, tree height, and crown area through ontogeny for each tree species (Shugart *et al*. 1981). In the race to the canopy, trees that allocate fewer resources to supporting stems and trunks per unit of height growth should grow faster than trees that allocate more (King 1981, Lawton 1984, Tilman 1988). The trade-off is in survival: self-supporting plants that allocate too little to stems may buckle under their own mass or break due to wind stress or other loads such as snow (King and Loucks 1978) or epi- phytes (Putz 1983, Putz *et al*. 1983).

The present study was conducted to evaluate the growth performance of 3- year old plantation of *Phyllanthus emblica* raised in the campus of J.P.University ,Chapra during the period 2015-2017.

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Table 1 Growth performance in P*hyllanthus emblica* during the period 2015-2017

Growth Parameters	2015				2016				2017			
	Site I	Site II	Site III	Mean	Site I	Site II	Site III	Mean	Site I	Site II	Site III	Mean
Height (cm) (%increase)	331.7	249.9	271.2	284.3	398.0 (19%)	349.9 (4%)	341.0 (25%)	362.9	470.0 (18%)	401.9 (14%)	234.6 (14%)	368.8
Diameter (cm)(%increase)	17.5	18.8	26.8	20.0	27.9 (59%)	26.0 (38%)	25 (72%)	26.3	40.9 (46%)	36.6 (40%)	36.7 (36%)	38.6
H: D Ratio (%increase or decrease)	33.1	29.0	12.2	24.8	14.3 (-56%)	13.5 (-53%)	34.8 (185%)	13.8	11.9 (-16%)	12.2 (-9.6)	10.7 (-69%)	11.6
Tree Volume (m^3) (%increase or decrease)	0.10	0.06	0.20	0.12	0.31 (210%)	0.24 (300%)		0.19	0.79 (154%)	0.54 (125%)	0.55 (173%)	0.63

Table 2 Monthly (cm/mon) and annual increment (cm/yr) growth in height and diameter in *Phyllanthus emblica*

Growth Parameters	Site I	Site II	Site III	Mean	Site I	Site II	Site III	Mean
	2015-16	2015-16	2015-16		2016-17	2016-17	2016-17	
Monthly increment in height (cm/mon)	5.53	8.33	5.82	6.56	6.0	4.33	8.87	6.4
Monthly increment in diameter (cm/mon)	0.87	0.85	0.15	0.6	13	10.6	11.7	11.8
Annual increment in height (cm/yr)	66.3	100	69.8	78.7	72.0	52.0	106.4	76.8
Annual increment in diameter (cm/yr)	10.4	10.2	1.8	7.47	1.08	0.88	0.98	0.98

MATERIALS AND METHODS

Location

The study site is situated between 25^0 36' and 26^0 15' N latitude and $84^0$25' -$85^0$15' E longitude in the southern part of Saran Division of North Bihar. Total annual rainfall values in 2015, 2016 and 2017 were 946.6 mm, 1018.9 mm and 1134.6 mm, respectively .In rainy season in 2015 81.56% of total rainfall occurred whereas in 2016 it was 75.44% and in 2017 77.30%.The rainfall values in rainy season varied in different years. The maximum temperature during the study period in 2015 ranged from 25.6 to 40.3℃ ; in 2016 from 25.5 to 42.0℃ and in 2017 from 27.0 to 38.5℃ .

The present study was conducted in the three year old plantation of *Phyllanthus emblica* raised in the campus of Jai Prakash University Chapra. The study was conducted during the period August 2015 to July 2017.Three year old 30 plants of *Phyllanthus emblica* was selected at three sites .All the selected individuals were marked with paints. The spacing between individuals was 2m×2m.

In the month of August 2015, July 2016 and July 2017 growth parameters such as height and diameter were measured. Further the H: D ratio and tree volume of trees were calculated. The height of seedlings was measured by using tape. The diameter at breast height (DBH) for tall seedlings at 1.34 m was measured. Monthly and annual increments in height and diameter were calculated from the difference between two measurements.

H:D ratio

H:D Ratio was calculated according to the following formula:

$$\text{H:D ratio(cm)} = \frac{\text{Height(cm)}}{\text{Diameter (cm)}}$$

Tree Volume: Tree volume (m^3) was calculated according to the following formula:

Tree Volume (m^3) =D^2H (Where D represents diameter and H as height).

RESULTS AND DISCUSSION

Height (cm)

In case of *Phyllanthus emblica* the values for height at three study sites ranged from 249.9 to 331.7 cm in 2015,341.0 to 398.0 cm in 2016 and 234.6 to 470.0 cm in 2017(Table 1).The mean value for three sites for height in 2015 was 284.3 cm; in 2016 362.9 cm and in 2017 368.8 cm. The per cent increment in height during the period 2016 and 2017 ranged from 4 to 25% and 14 to 18%, respectively. The monthly increment values in height during the period 2015-2016 ranged from 5.53 to 8.33cm /mon whereas during the period 2016-2017 it ranged from 4.33 to 8.87 cm/mon .The mean value of monthly increment in height was 6.56 cm/mon in 2015-2016 and 6.4 cm/mon in 2016-2017.The annual increment values in height during the period 2015-2016 ranged from 66.3 to 100 cm /yr whereas during the period 2016-2017 it ranged from 52.0 to 106 cm/yr .The mean value of annual increment in height was 78.7 cm/yr in 2015-2016 and 76.8 cm/yr in 2016-2017(Table 2).

According to Shrivastava (2019) in case of *M.indica* the mean value for three sites for height in 2015 was 240.2 cm, in 2016 311.1 cm and in 2017 387.3cm .The per cent increment in height during the period 2016 and 2017 ranged from 7 to 64% and 19 to 32% ,respectively .The monthly increment values in height during the period 2015-2016 ranged from 1.6 to 12.0 cm /mon whereas during the period 2016-2017 it ranged from 4.5 to 10 cm/mon .The mean value of monthly increment in height was 5.9 cm/mon in 2015-2016 and 6.3 cm/mon in 2016-2017 . The mean value of annual increment in height was 70.9cm/yr in 2015-2016 and 75.9 cm/yr in 2016-2017.Similarly according to Shrivastava (2019) in case of *P.guajava* the mean value for three sites for height in 2015 was 255.1 cm; in 2016 321.5 cm and in 2017 395.6 cm. The

per cent increment in height during the period 2016 and 2017 ranged from16 to 38% and 19 to 99%, respectively. The mean value of annual increment in height was 66.4 cm/yr in 2015-2016 and 74.0 cm/yr in 2016-2017.Further in case of *S.cumini* ,in another fruit tree according to Shrivastava (2019) the values for height at one site were 158 cm in 2015; 218.5 cm in 2016 and 286.3 cm in 2017. The per cent increment values in height during the period 2016 and 2017 were 38% and 31% ,respectively. The monthly increment value for height during the period 2015-2016 was 5.02 cm /mon whereas during the period 2016-2017 it was 5.65 cm/mon. The annual increment value for height during the period 2015-2016 was 60.2cm /yr whereas during the period 2016-2017 it was 67.8 /yr. This indicates that the growth in height was more in *P.emblica* compared to other fruit trees such as *M.indica, P.guajava* ,and *S.cumini.*

Diameter (cm)

In case of *Phyllanthus emblica* the values for diameter at three study sites ranged from 17.5 to 26.8 cm in 2015 25.0 to 27.9 cm in 2016 and 36.6 to 40.9 cm in 2017 (Table 1).The mean value for three sites the value for diameter in 2015 was 20 cm ,in 2016 26.3 cm and in 2017 38.6 cm. The per cent increment in diameter during the period 2016 and 2017 ranged from 38 to 72 and 36 to 46 %, respectively. The monthly increment values in diameter during the period 2015-2016 ranged from 0.15 to 0.87 cm /mon whereas during the period 2016-2017 it ranged from 10.6 to 13 cm/mon .The mean value of monthly increment in diameter was 0.6cm/mon in 2015-2016 and 11.8 cm/mon in 2016-2017. The annual increment values in diameter during the period 2015-2016 ranged from1.8 to 10.4 cm /yr whereas during the period 2016-2017 it ranged from 0.88 to 1.08 cm/yr.The mean value of annual increment in diameter was 7.47 cm/yr in 2015-2016 and 0.98 cm/yr in 2016-2017(Table 2).

Shrivastava (2019) has reported in case of *M.indica* the mean values for diameter at three study sites in 2015 was 19.4 cm; in 2016 23.4cm and in 2017 28.2 cm. The per cent increment in diameter during the period 2016 and 2017 ranged from 13 to 27 % and 15 to 26 %, respectively. The mean value of monthly increment in diameter was 0.33 cm/mon in 2015-2016 and 0.41 cm/mon in 2016-2017. The mean value of annual increment in diameter was 3.9 cm/yr in 2015-2016 and 4.8 cm/yr in 2016-2017.In another fruit tree in case of *P.guajava* the mean value for three sites for diameter in 2015 was 22.7 cm; in 2016 34.3 cm and in 2017 46.8 cm .The per cent increment in diameter during the period 2016 and 2017 ranged from 40 to 74% and 11.5 to 13.4 %, respectively. The mean value of monthly increment in diameter was 0.97 cm/mon in 2015-2016 and 1.04 cm/mon in 2016-2017.The mean value of annual increment in diameter was 11.7 cm/yr in 2015-2016 and 12.5 cm/yr in 2016-2017. In case of *S.cumini* the per cent increment in diameter during the period 2016 and 2017 were 42% and 53%,respectively. The annual increment values in diameter during the period 2015-2016 was 60.2 cm /yr .

Singh (2013) has reported the growth in height and diameter in *Phyllanthus emblica* on coal mine spoil. On after 20 months of plantations the values for height ,diameter, height: diameter ratio and tree volume were 122(cm)1.69(cm),76.30and 312.30(cm3) at Jayant Project Singranli however these values were 319 (cm), 23.60 (cm),13.52 and 177670(cm3) after 16year of plantation, At Bina project Coal mine spoil after 16years of plantations the values for height, diameter, height: diameter ratio and tree volume were 368 (cm),36.00(cm)10.22 and 476928(cm3),respectively Singh (2013).The present study in dicated that the growth in diameter in *P.emblica* was more than the other fruit trees such as *M.indica, S.cumini* and *P.guajava*.

H:D ratio

In case of *P .emblica* the values for H:D ratio at three study sites ranged from 12.2 to 33.1 in 2015, 13.5 to 34.8 in 2016 and 10.7 to 12.2 in 2017 (Table 1).The mean value for three sites for H:D ratio in 2015 was 24.8 cm ,in 2016 13.8 and in 2017 11.6 cm. At one site during the period 2015-16 the H :D ratio increased by 185% whereas at two sites the decrease in H:D ratio ranged from 53 to 56 % whereas in 2016 -17 it decreased by 9.6 to70% .

Tree volume (m3)

In case of *Phyllanthus emblica* the values for tree volume at three study sites ranged from 0.06 to 0.20 m3 in 2015,0.03 to 0.31m3 in 2016 and 0.54 to 0.79 m3 in 2017 (Table 1).The mean value for three sites for tree volume in 2015 was 0.12 m3 ; in 2016 0.19 m3 and in 2016 -2017, 0.63 m3.Except for one site during the period 2015-16 in which tree volume decreased by 8% but in other sites it increased by 210 to 300 % and in 2016-2017 it increased by 125 to 173%. The present study indicated satisfactory growth performance in *P.emblica* in terms of growth in height, diameter and tree volume during the period 2015-2017 in fallowland of J.P.University Chapra campus.

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References

Ghosal S, Triethi VK, and Chauhan S (1996).Active constituents of *Emblica officinalis*: Part 1.The chemistry and antioxidative effects of two new hydrolysable tannins, Emblicanin A and B, *Indian Journal of Chemistry*.; 35B: 941-948.

King, D. A. (1981). Tree dimensions: maximizing the rate of height growth in dense stands. *Oecologia* 51:351-356.

King, D. A., and 0. L. Loucks. (1978). The theory of tree bole and branch form. *Radiation and Environmental Biophysics* 15:141-165.

Lawton, R. 0. (1984). Ecological constraints on wood density in a tropical montane rain forest. *American Journal of Botany* 71:261-267.

Putz, E E. (1983). Liana biomass and leaf area of "tierra firme" forest in the Rio Negro Basin, Venezuela. *Biotropica* 15:185-189.

Putz, E E., P. D. Coley, K. Lu, A. Montalvo, and A. Aiello. (1983). Uprooting and snapping of trees: structural determinants and ecological consequences. *Canadian Journal of Forest Research* 13:1011-1020.

Shugart, H. H., D. C. West, and W. R. Emanuel. (1981). Patterns and dynamics of forests: an application of simulation models. Pages 74-94 in D. C. West, H. H. Shugart, and D. Botkin, (Eds.) Forest succession: concepts and application. Springer-Verlag, New York, New York, USA.

Singh ,B.K.(2013) Evaluation of Growth Performance of Tree species planted on coal-mine spoil.Ph.D.thesis,J.P.University Chapra 188p.

Tilman, D. 1988. Plant strategies and the dynamics and structure of plant communities. Princeton University Press, Princeton, New Jersey, USA.

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