International Journal of Scientific Research and Engineering Development-– Volume 9 Issue 2, Mar-Apr 2026
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Growth and Phenologically Study of Plantations: A Review

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Wasteland:

In India about 68.35 million hectares of the land is as wastelands. A wasteland is degraded land without vegetation. National Wasteland Development Board has been established to tackle the problem of degradation of lands; restoration of ecology and to meet the growing demands of fuel wood and fodder at the national level .There are various categories of wastelands.

Fallowland:

Fallowland includes all that land which was used for cultivation but is temporarily out of cultivation .Fallowland is of two types viz., current fallow, fallow of one year is called 'current fallow' while that of 2 to 5 year is classified as "fallow other than current fallow'. Fallowlands is left uncultivated from 1 to 5 years to help soil recoup its fertility in the natural way depending upon the nature of soil and the nature of farming. Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conservation of water, preserving soil and the supporting wildlife. There are several benefits of plantations some of which are as follows: Cleaner air across the country; cleaner water and natural filtration ; carbon sequestration; controlled temperatures; a new habitat for wildlife; trees active lifestyles; raise property value ; trees shield from ultra-violet rays ; trees provide food; trees heal.

Plantation

The importance of trees and benefits of trees are numerous such as save water, conserve energy, reduced violence and unity, and save earth from earth quake. *T. grndis* the most important commercial timber species in India more than 7 million hector of teak plantation have been done. Gopikumar et al (2002) have evaluated the effect of garbage and coir dut on establish and growth of seedlings of teak and other species. Teak is a higher quality deciduous timber species native to peninsular India, Burm and Indonesia.

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Troup (1921) has reported that teak grows naturally in Southern Asia from the Indian Subcontinent through Burma Thailand to laces, aproximatry 90 and 250n latitude and 730 to 1030E longitude . Former(1972) has reported on februable sites a clear bole of up to 25 or 27 m and diameter 1.8 and 2.4 m. According to FAO (1956) teak is generally fast growing in young stage but on rotation basis is its overall growth rate was not outstanding. Briscoe and Ybarra –Conoroda (1971) rated teak as moderate fast growing species. Weaver (1993) has reported rapid growth in height in teak between 10 and 50 year after with it declines in India. Logu et al (1988) have estimated above ground biomass production in teak between 2.1 and 273 t/ha for ages ranging from 5 to 97 years respectively. Kwame et al (2014) have studied the growth performance of teak, coppice two year after clear cutting and reported that height and diameter significantly influence the number of coppiced shoots .The number of sprouts in stomps cut at height of about 15 cm above ground had maximum number of sprouts. The stamps diameter was reported possibly correlated that number of sprouts and liter height .The recommended that the management of coppices after clear cutting through thinking was important for better quality shoots. Koppad and Rao (2013) have recorded plant height , dbh , wood density in five year and ten year old plantation of teak with high input management parties such as application of organic and comically fertilization, integration, wood management and inter cultural operations and reported that plantation raised with height input management practices recorded 19.471 and 59.552 tones wood biomass per hector in five and ten years teak plantation as compare to only 8.866 and 31.517 tones in poorly managed plantations ,respectively. Establishment of forest plantation on wastelands community lands and *i*n agricultural land would not only fulfill the target of covering the forest area but also mitigate the carbon content from atmosphere. Gogate et al (1995) have reported the growth of teak at initial stages was faster due to fertilizer, application and irrigation, proper moisture variability in juvenile stage made the plants to prolong the growth without going to dormant condition .Haque (1996) observed that the weeding and inter cultivation especially seedling stage avoids competition for light and nutrients between plants and weeds, which helps in better growth of teak. Vidyasagaran et al (2014) have evaluated the effect of two weeks decay stored materials on the growth and vigor of teak seedlings; and recorded 95 to 99% several .The have recommended that municipal garbage can be used as a shutable growing media for the propagation of commercially important tree species *T.grandis* seedlings which is use aforestation because plant growth and nitration are inhenesd by using municipal garbage.

The genus *Dalbergia* was named after Swedish botanist N.G. Dalberg. This genus consists of 150 species (trees, shrubs and woody climbers) throughout the tropical region. In India and Burma 42 species

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including 20 tree species occur. *D.sissoo* is the most valuable timber species in India. It is the most multipurpose plantation tree. Due to its fast growth, quality timber, easy propagation and drought resistance. *D.sissoo* has been the most valuable plantation species. This species is planted at everywhere such as agricultural fields, canal sides ,ponds banks, wasteland etc .There is much bigger profit from plantation of this species due to short rotation of timber harvest with comparison Troup (1921) to profits from agricultural crops. This species can attain upto 40m height and 2.4m girth with clear bole unto 15 m under favorable conditions. Chandrasekharaiah and Prabhakar (1987) have evaluated the height growth and dry matter production in *D.sissoo* which produced significantly higher total harvestable biomass per plant as 70.01kg. Dhukia et al (1988) have reported the yield of four fodder crops under *D.sissoo* plantation than *Albizia lebbeck* plantation .Nath et al (1990) have reported good to moderate performance for social forestry under different soil conditions .Sharma et al (1992**)** have evaluated the growth performance of *D.sissoo* intercrop with wheat and paddy and reported mean height and dbh 10.36 m and 53.45 cm and total timber 1.25 m^3 and small timber 7.1 m^3 and fuel wood 77.45 q. Singh et al (1998) using *Rhizobium* and VAM fungi, vermicompost ,compost ,mulch combination with *D.sissoo* indicated better results. Uniyal et al (2003) have evaluated performance of multipurpose trees and reported *D.sissoo* as most suited for restoration of abandoned agricultural and degraded lands. Tiwari et al (1992) have reported tree growth in *D.sissoo* increased linearly with height and diameter growth better upto 4 year old. Height and diameter growth are influenced by a combination of genetic potential and phenological and morphological responses to environmental factors (Vogt et al.,1983;Cole and Newton ,1987;Harrington et al.,1991;Kelty et al .,1992; DeLong,1991 a,b;Bi and Turvey,1994; Leiffers and Stadt,1994; Comeau and Sachs,1996; Simard and Heineman ,1996; Davis ,1998;Mustard and Harper ,1998; Makinen ,1998;Wang ,1998)**.** Litter depth, slope, aspect seasonal climate ,tree species and age, elevation ,site preparation , stock type ,provenance and site quality also affect height and diameter ratio (Zimmerman and Brown,1997;Burton ,1993; MacLsaac and Navratil ,1996; Davis ,1998; Mustard and Harper.1998). Height ,diameter rato has been involved in the determination of the influence of varied growth ,variables on height and diameter of trees. Cremer et al (1982) and Nykaner et al (1997) have used height and diameter ratios as gauge for susceptibility to snow and wind damage**.** Lommanter and Helles (1987) and Nykanen et al (1997) have reported in conifers increased probability of damage with increased height, diameter ratios. It has been reported that for every tree species height and diameter profile and survival varies from site to site ,climate factors and other conditions (Piotto 2007).In many studies the performance of different tree plantations have been evaluated.(Makela et al .,2000; Sievanen,1993; Landsberg and Waring

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1997;Valentine et al.,1997; Bartelink,1998 ; Albrektson and Valinger,1985; Hashim,2005 Piotto et al 2003).Rajdeep and Soni (2002) have purposed survival growth index for the performance of the tree plantation stands.

Phenology:

Linnaeus (1707-1778) is called as "father" of modern plant phenology. He has systematically recorded flowering for many years in 18 locations in Sweden. He has recorded climatic conditions when flowering occurred. The study of plant phenology has great significance because it provides knowledge about plant growth pattern and effect of environment on flowering, fruiting, leafing and other phenological processes (Zhung et al 2006). Several workers have studied phenology of tropical dry deciduas forest of India (Singh and Kushwaha2005a) and other types of forest of India (Singh and Singh 1992; Prasad and Hegde 1986; Sundarpandian et al 2005). Nath (2012) has studied plant phenological events of some dominant tree species of Sri Suriya Pahar of Goalpara Asam and reported that leaf initiation was started in February and continued to May. The peak period was March–April .The flowering was reported in March whereas the peak period of maturation of fruit was May – June. Tanjina et al (2016) have studied phenological events in 65 important plantation tree species in Bangladesh and reported that flowering, fruiting and seed maturity period varied from species to species. In most of the species flowering occurred in March-May and fruiting in April-June. Hasan (1971), Alam et al (2005) and Sheikh and Matin (2007) have reported flowering, fruiting and seed collection time in some species of Bangladesh. Nanda (2012) studied different phenophases of 45 species in dry deciduous forest of Bhadra wild life Santurary Karnatka, India and has reported peak month of flowering in dry season during April .Singh and Singh (1994) ;Sun et al (1996) have indicated rainfall seasonality as the major abiotic factor which controls timing ,inducing and duration of flowering and fruiting however Nanda (2012) has reported negative significant influence on flowering. Wright and Van Schaik (1994) and Wright (1996) have reported light and rainfall are the main factors which influence flowering. Schongart et al (2002) have suggested that during dry season flowering water stored in tree trunk support in high stem water potentiatal an flowering .During dry season trees are leafless and flowers attract pollinators. Koelmeyer (1959); Janzen (1967);Daubenmire (1972) and Frankie et al (1974) have suggested that in seasonal tree where annual rainfall is more than 100 cm peak flowering occurs in dry season. In Bangladesh in plantation of common tree species the flowering period was observed during 3 to 5 months.In tree species of dipterocarp forest of Malasya flowering occurs during February to March (Yap1982).Yadav and Yadav (2008) reported tropical dry deciduous forest flowering

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activity continues with two peaks first in March and April and second in July and August annually .In drought period flowering has been reported in 50% woody species showing synchronous activity .Booth and Ramakrishan (1981).,Murali and Sukumar (1994) and Yadav and Yadav (2008) have concluded that flowering and leaf initiation synchronoution is related to moisture ,temperature and dry length. Borchert (1994) also reported that stored water enables flowering and leaf flusing during the dry season .Wright (1991) suggested that changes in moisture availability may affect nitrogen mineralization and phosphorus flush from decaying litter which synchronize with plant activity. Sundarapandian et al (2005) reported that in tropical forests at Kodayar flower-bud initiation continued whole year but small peak of activity was observed in August and November whereas flower maturation peaked in February –May and also in September. Kakim and Yadav (2001) reported that in sub-tropical forests of Manipur flowering in the month of April to September. Similarly flowering occurred in the month of April in maximum plant species. Shrestha and Shresthsa (1998) reported flowering in maximum species in the month of April and May. Zhang et al (1997) reported that different parts of China peak flowering occurred in May whereas in India flowering occurred in the month of January and February (Jadeza and Nakkar 2010).The differences in flowering period was observed due to differences in climatic and geographical area. Chapman et al (1999) have reported fruiting peaks occur in the wet season .Rathcke and Lacey (1985) suggested that fruit ripening or maturity occur in pre monsoon dry period which increases dispersal to avoid pathogen infection. (Prasad and Sharathechandra 1984 reported that in low relative humidity dehiscence in dispersed fruits. Opler et al (1980) have studied the pattern of phenological events used in characterization of vegetation type, the initiation of growth in plant and changes in phenology by different environmental factors. Walter (1973) have studied the influence of temperature and moisture on phenology. Several workers have studied the phenology of tropical tree species (Borchert 1983; Croat 1975; Frankie et al 1974; In India the phenology of tree species have been studied by Boojh and Ramakrishna 1981 ;Shukla and Ramakrishnan(1985) and Sundriyal (1990).Leaf production toword end of dry season before rains has been observed in tree species by several workers (Frankie et al .1974 Shukla and Ramkrishnan1982., Singh 1992; Sundriyal1990). In dry deciduous tree species leaf fall peak in cool and dry winter months (October to February)has been reported by Yadav and Yadav (2008);Prasad Hegde (1986);Singh and Singh(1992) because in the dry session soil moisture decreases and water stress condition staged.

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