Journal of Applied and Natural Science 7 (1) : 26 - 29 (2015)

JANS

A field survey on abundance of biofuel plant species in Alur Taluk of Hassan District, Karnataka, India

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Received: August 17, 2014; Revised received: November 26, 2014; Accepted: February 4, 2015

Abstract: There are more than 150 species of plants that could be used for biofuel production. Important among them in Karnataka are Honge (*Pongamia pinnata*), Neem (*Azadiracta indica*), Hippe (*Maduca latifolia*), Jatropha (*Jatropha curcas*) and Simarouba (*Simarouba glauca*). A field survey was conducted in Alur taluk of Hassan District, (75º 9´ to 12º 9´) Karnataka, to know the abundance of biofuel plant species and to estimate resource availability for extraction of oil and production of Biodiesel. The number of Households in the study villages ranged from 120 to 600 with population ranging from 60 to 2,500 and number of productive Honge trees varied from 3 to 2,000 trees/village yielding on an average around 2 to 10 kg seeds per tree with very few Neem and Hippe trees but Jatropha plants were present in every village with very low yielding potential (50-100 grams per plant). Majority of the biofuel plants present were in vegetative stage and few were yielding. The yield of biofuel plant species is quite promising and the process of seed for oil extraction is possible and provides employment to the rural youth in the taluk. The substantial demand has been noticed in Alur taluk for Honge and Neem oil cakes and the availability is meager. Substantial scope is available for growing of biofuel trees, seed collection, processing and marketing providing additional employment to rural people. There is an increased demand for the biofuels and by utilizing the available resources the rural youth can start their own enterprise.

Keywords: Biofuel, Hippe, Jatropha, Organic Manure, Pongamia, Rural employment

INTRODUCTION

India is the fourth largest consumer and net importer of crude oil and petroleum products in the world after United states, China and Japan. India is producing only around 30% of required fossil fuel and importing 70% of the demand from middle east and Arab countries. With the increase in human population there is increased pressure for consumption of crude oil due to increased vehicle population which has resulted in greater demand for alternate fuel so as to counter the problems of being exhausted in the near future (Shinoj *et. al.* 2011). Lot of works has been carried out by researchers about providing alternate fuel to fossil fuels but none of them are convenient and efficient as the biologically prepared /manufactured biofuels. The main resource for these biofuels which are in plenty and renewable are the plant products (seeds) (Demirbas, 2002). There are more than 150 species of plants that could be used for biofuel production, the important tree species in Karnataka are Honge (*Pongamia pinnata*), Neem (*Azadiracta indica*), Hippe (*Maduca latifolia*), Jatropha (*Jatropha curcas*) and Simarouba (*Simarouba glauca*). These trees are available in plenty in rural areas as it was a part of Agroforestry component in farmers land growing with less water requirement and on bunds or on unfertile lands. Utilizing the available resources for production of Biofuel is the need of the hour. Biofuels in the form of liquid fuels derived from plant materials, are entering the market, driven mainly by the need to reduce climate gas emissions, but also by factors such as oil price spikes and the need for increased energy security (Basavaraj *et al.,* 2012). The challenge is to support biofuel development, including the development of new cellulosic technologies, with responsible policies and economic instruments to help ensure that biofuel commercialization is sustainable. Responsible commercialization of biofuels represents an opportunity to enhance sustainable economic prospects in India, Africa, Latin America and Asia.

Keeping in view of various advantages of biofuels, the,study was conducted in Alur taluk of Hassan district in Karnataka with the objective to identify the abundance and availability of different biofuel tree species in Alur taluk, Hassan district as feedstock for production of biofuel in the district, to study the alleviation of income of farmers with intervention of these biofuel species at village level creating local market and to study the socio economic characteristics of the Biofuel growers after the intervention.

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MATERIALS AND METHODS

The study was conducted in Alur taluk of Hassan district (75º 9′ to 12º 9′) in Karnataka of India during 2010-11 to make an inventory of presence of biofuel plant species and to assess the availability of resources for biofuel production in Hassan district. Alur taluk is the smallest taluk in Hassan district with a total population of 86,071 with an area of 434.35 sq.km. It has 259 villages in the taluk and is 12 kms away from the District Head quarters, Hassan. Coffee, Arecanut, Ragi and Paddy are the main crops in the area with fairly large extent of uncultivated/Barren lands. Alur taluk has 15 Gram Panchayth, from each Gram Panchayath two villages were selected (11.5% sampling). The villages selected were true representative of the Gram Panchayath with respect to population of Biofuel trees availability. An average of two villages for population of five biofuel species viz., Honge (*Pongamia pinnata*), Neem (*Azadiracta indica*), Hippe (*Maduca latifolia*), Jatropha (*Jatropha curcas*) and Simarouba (*Simarouba glauca*) which were available locally in a Gram Panchayath was taken for comparison. Field Survey was conducted using schedule in all the 30 villages interviewing ten farmers in a group in each village and the questionnaire covered the social economic conditions of the farmers like landholding, income from land and income from selling biofuel oilseeds, knowledge of uses of biofuel and its byproducts etc. were covered in the schedule. The previous years income from Agriculture was compared to the income they got during the current year to estimate the raise in income from Biofuels due to higher value for the seeds. The yield of seeds and oil was projected to year 2020 for assessing the possibility of establishing Biofuel unit in Hassan district.

RESULTS AND DISCUSSION

The average number of households in the study villages ranged from 120-600 with an average population ranging from 60 to 2,500 and the average land holdings of the village in a Gram panchayath ranged from 120 to 3,000 acres with community land in every villages ranging from 8 to 500 acres (Table 1). In all these villages productive Honge(*Pongamia pinnata*) trees are present and the number varied from 3 to 2,000 trees/village yielding on an average around 2 to 10 kg per tree. In Alur taluk, the number of Neem (*Azadiracta indica*), and Hippe (*Maduca latifolia*), trees was few but Jatropha (*Jatropha curcas*) was present in every village with very low yielding potential (50-100 grams per plant). In all these villages Biofuel plant species like Honge (*Pongamia pinnata*), Neem (*Azadiracta indica*), Hippe (*Maduca latifolia*), Jatropha (*Jatropha curcas*) and Simarouba (*Simarouba glauca*) were present which are in various growth stages and some of them are yielding. These biofuel plants are planted in waste land and on bunds which will not change the Land use pattern of the location which is reverse as documented by Kim *et al.* (2009) where, the resource material of Biofuels were planted in the cultivable land. Keeney and Hertel (2008) in their indirect land use impacts of US biofuel policies have also indicated the danger of planting the biofuel pants in the cultivable land.

Since Alur comes under transitional zone receiving good amount of rainfall (1599.3 mm annually), abundant Honge trees are found in the riverside yielding few seeds, as the trees put forth more of vegetative growth and due to stagnation of water the Neem population is very less. In high rainfall receiving part of the taluk like Talur and Palya (0.45 kg/tree in each Gram panchayath), the yield of Honge is very less compared to drier part of the taluk like in Ganjgere (3.56 kg/tree) and Kanthur (3.23 kg/tree) (Table 1).

The resource availability in the villages of Alur taluk as a whole is promising and likely to increase with the intervention of Biofuel Park activities. More number of biofuel plants are being planted and are likely to come to bearing in another two to three years which is a promising development in the field of Biofuels in Hassan district. The farmers are realising some income from selling the seeds and oil of Honge to the buyers in the market @ Rs. 20 and Rs. 50 respectively (Table 2) and in some villages of Alur taluk the farmers who have formed associations of oilseed growers under the guidance of Biofuel Park Hassan have started expelling the oil from the seeds available in the village using the hand operated oil expeller introduced by the Biofuel park, Madenur. Oilcakes of pongamia, mahua and neem the byproduct of oil extracting is being utilized for application to the land as fertilizer for manurial value in improving the productivity of annual crop plants and their impact on soil nutrient status are high (Ramesh *et al.,* 2009 and Shivakumar *et al*., 2011). Britz and Witzke, (2008) have analysed the economic and environmental impacts of first generation biofuel processing in the EU but with different impact as they were using cultivable lands for producing biofuels.

Jatropha is found abundantly in the boundaries of backyard, farm bunds and in wasteland. The fence of coffee estate is planted with *Jatropha curcas* but it is pruned during monsoon and the flowering twigs are cut resulting in low or no production of seeds which can be noticed in table 1. The productivity of Jatropha in Alur taluk ranges from 10 grams to 500 grams per plant. Proper pruning activities will help in improving the yield and getting better returns as there is greater demand for seeds and oil in the market. From the survey it was found that approximately 28 % of Pongamia, 47.88% of Neem and 14.08% of Mahua seeds were traded through Agriculture Produce Marketing Corporation and the rest is traded through retail agents or used for the domestic consumption. The gap between seed production potential and the quantity traded is enormous. This wide gap is mainly due to huge demand of seeds for the local (domestic) consumption for oil and tannery industry. Similarly, low opportunity cost of seed collection

Table 1. Socioeconomic details of 15 Grama Panchayaths in Alur taluk of Hassan district.

S. N.	Name of Gram panchayath	Avg. House hold village	Population in numbers	Land holding in acres	Community lands (acres)	Average no. of Pongamia Pinneta trees per village	Average production of Pongamia Pinneta / Village (Kg/ tree)	Productivity of Pongamia Pinneta / Village (Kg/ tree)	Average no. of Jatropha curcas per village	Average production of Jatropha curcas / Village (Kg/tree)	Productivity of Jatropha curcas / Village (Kg/tree)
1.	Kundur	50	235	205	29	45	90	2.0	3000	40	75.0
2.	Thaluru	75	485	250	35	514	230	0.45	175	09	19.4
3.	Palya	200	1150	1475	90	325	725	0.45	1250	115	10.9
4.	Hunasavalli	55	225	300	17.5	320	395	0.81	2250	68	33.1
5.	Byrapura	49	330	325	10	30	60	2.0	900	30	30.0
6.	Madabalu	215	1250	650	50	190	270	0.7	3000	140	21.4
7.	Mallapura	110	475	300	21.5	55	58	1.05	1150	20	57.5
8.	Hanchur	134	700	400	80	298	550	1.84	1110	14	79.3
9.	Magge	600	2500	1100	160	100	200	2.0	500	10	50.0
10.	Kanathur	123.3	600	790	23.3	65	210	3.23	410	06	68.3
11.	Doddakanagal	275	1650	1850	265	1100	800	0.72	2150	28	76.8
12.	Kadalu	168	950	640	79	108	240	2.22	2600	55	47.3
13.	Ganjigere	820	4376	3790	267.25	51	182	3.56	1987	395	5.0
14.	Abbana	165	875	2650	102.5	65	110	1.69	850	95	8.9
15.	Karagodu	60	300	787.5	94	80	125	1.56	1020	112	9.1

Table 2. Average prices of Pongamia seeds and oil over the years.

Sl. No.	Items	Price (Rs./Kg)			
		1994-1995	1999-2000	2002-2003	2011-2012
1	Oil	14	23	30	50
2	Seed	3.5	7	8	20

as compared to daily wage rate is also responsible for the low seed collection.Since bringing a larger area under biofuel yielding oilseed plants in the short run is not possible and research and extension efforts would be required to make it a viable option for blending. It is assumed that only 5% of the total biofuel required for blending would come from oilseed trees during 2012, and this would go up to 20% by 2020. Based on these assumptions, the annual requirement of biofuel from oilseeds during 2012-14, 2015-19 and 2020 have been projected at 5%, 10% and 20% of the total biofuel required, respectively. Oilseed productivity is expected to increase between now and 2020 with improved cultivars, better management practices and increased awareness of farmers about Biofuel trees cultivation. With increased productivity, a larger area could be brought under cultivation, thereby increasing biofuel available for blending (Shinoj *et al.,* 2011). There is every possibility of putting up of a Biofuel extraction unit in Hassan district encouraged from the success story from Donald (2011) in Africa as there is increased demand for the biofuels and by utilizing the available resources. The rural youth can start their own enterprise in collaborating with Biofuel Park, Madenur who will guide the youngsters for the profitable venture.

Conclusion

From the study it has been noticed that there is abubdant availability of resources in Alur taluk for production of biofuels and there is scope for further plantation of Biofuel plant species on bunds and waste lands. After entry of Biofuel park, Madenur in 2007, the rates of Honge seeds and Jatropha seeds in Hassan district have risen as the farmers were educated about the benefits and demand of the resources. The rates of Honge seeds rose from mere eight rupees to twenty rupees in a span of eight years and farmers are taking the seeds to market where as earlier they were selling to the petty business men who were visiting the village in bicycle for very less price. The oil expelling in the village with the help of Hand operated oil expeller has provided value addition instead of selling of seeds in the market. They can market the oil at a good price and can get reasonably better price for the oil cake that has been produced as a byproduct. The expelling of oil has generated employment to the rural youth who are migrating to the city in search of Jobs in Bakery, garment and other factories or as labourers in building construction. In mere future small scale Biofuel extracting units can be established in Alur taluk as the production from the trees which are in vegetative stage start yielding.

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