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MANAGING ENERGY CRISIS WITH BIOMASS: SCOPE OF *DACTYLOCTENIUM AEGYPTIUM* AS A SOURCE OF BIOENERGY

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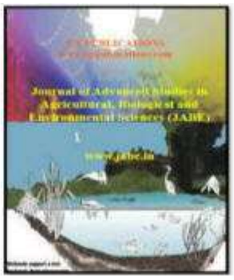

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ABSTRACT

Energy is an integral part of any socio-economic development for raising the st living and to improve the quality of life of the people (Khoshoo 1988).With the crisis most of the countries became aware of their total dependence on only o energy. It also became clear that such an abrupt crisis would not have affected if a broad energy policy involving many sources had been followed. The increas population and diminishing fossil fuel stocks have challenged us to look for the sources of energy. Besides the conventional energy resources there are many conventional resources. Biomass as an energy resource is gaining attention of During photosynthesis solar energy is trapped into- light harvesting molecules chloroplasts by reduction of CO_2 into carbohydrates, fats and proteins. Radiant stored in plant is primary production which later on creates biomass or biomat can be formed in terrestrial and aquatic conditions. Biomass includes wood, cr herbaceous plants and microorganisms as well. It also includes animal waste, n The biomass production depends upon the photosynthetic efficiency of plants intensity of available light. Various compounds which build up and store energ of plant biomass are cellulose; hemicellulose; lignin; water soluble materials lik aminoacids and aliphatic acids; ether and alcohol soluble constituents like fats, waxes, resins and many pigments; proteins; etc. The proportions of these mate from plant to plant. Cellulose constitutes major portion of cell wall and the fun unit of which is glucose. Enzymatic hydrolysis of cellulose leads to production c which in turn can be converted into ethanol by fermentation processes. The t biomass has been used as food, vegetables, fiber, furniture and other purposes etc. The biomass can be converted into energy by non biological process as v biological process which involves the conversion of organic materials into ener fertilizer, food and chemicals through biological agents. The cellulose and othe materials can be converted by enzymatic degeneration or degradation or by ar digestion or aerobic digestion employing microorganisms. Many nations have p attention on the bioenergy programmes and are seriously engaged in bioenerg and development programmes. High Density Energy Plantations (HDEP) is the p planting trees and other plants on waste lands, road sides , along railway track fire wood , wood and other fuel generating programmes.It provides quick and returns of energy and also opportunities for permanent income and employm Keeping in view of climatic and edaphic factors the annuals, deciduous trees c planted to meet the energy demand. The plants should have the qualities like f disease resistance, drought resistance, less palatable to cattle, early propagabl caloric value, absence of deleterious volatile materials, high yield of biomass, e context it is considered that an annual and a prolific weed, crow-foot grass

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Dactyloctenium aegyptium (L.) Beauv.which fulfills many of such qualities, as a
biomass. In this paper it is discussed about the allocation of energy into its diff
and the uses of its biomass. It is hoped that this plant be considered as an exce
energy source and fulfill the energy needs to some extent.

Introduction

It was soon realized that mankind is living in a petroleum society and that this crisis threatened the lifestyle and also the national security because most of the defence use petroleum as energy. Such an abrupt crisis would not have affected any country if a broad energy, integrated energy policy had been followed. Gradually increasing world human population and decreasing stocks of fossil fuels have challenged us to look forward for the alternative energy resources.Though there are many kinds of conventional and non convenventional sources of energy biomass is playing a crucial role in fulfilling the human needs to a large extent. Plants are considered as photoautotrophs as the different photosynthetic pigments like chlorophyll-a, chlorophyll-b, chlorophyll-c,xanthophylls and carotenoids absorb light of different wavelengths and prepare different types of organic materials.Radiant energy stored in plant is known as primary production which later on creates biomass or biomaterial.The energy remaining as organic matter is calledas net primary productivity(NPP). And is expressed as Kcal or $g/m^2/yr$.Biomass includes wood, trees, herbaceous plans, microorganisms,etc. And also it includes animal waste, milk, manure, etc.The photosynthetic efficiency affects the accumulation of biomass as it depends o plant efficiency and light intensity. We have abundant sunshine and in this area the crow-foot grass is growing profusely as a weed.Cellulose is abundant in plants and this can be extracted and converted into glucose by enzymatic action of microorganisms. Glucose in turn can be converted into ethanol by fermentation which can be used as a substitute for fossil fuels.In this connection the biomass studies were conducted and allocation of energy to various parts of the plants of Dactyloctenium aegyptium(L.)Beauv. is studied.

Material and methods:

The material for the present study is the crow-foot grass, Dactyloctenium aegyptium an annual therophyte.It has been found to occur in eight morphological forms considering many morphological characters. Detailed information is given in the paper published in biodiversity, see Mary and Vijaya Koteswari, 2003. The method adopted for biomass production, allocation of energy for different parts has been carried out in the laboratory.For this purpose the samples in the months of August and October(peak months of vegetative and reproductive phases) containing30 plants collected at random were separated into root, stem(culms),leaf and inflorescence. Initially the fresh weight was determined and each of the above plant parts was dried for 48 hrs in a dry air oven at 80^0 C and then weighed The difference between the fresh and dry weights gives a measure of the moisture content. The dry weight was used to estimate the biomass production.

Results

The average percentage of dry matter and moisture content of root, culm, leaf and inflorescence of all the forms of D. aegyptium were determined during the peak periods of vegetative and reproductive phases, i.e., August and October, months and results are given in the table. **1**

The plants showed increased dry matter in the month of October. The root of prostrate forms, C5 and L3, showed higher percentage of dry matter**.** Here generally leaves had more dry matter than the culms and inflorescences. It is also evident from the table that the moisture content was more in the above-ground parts than the below-ground parts.

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Energy estimates were made mainly based on crude dry matter. The data are summarized in the table **2** a classified account is presente below.

a) Allocation of drymatter(%) to support organs (S.O.) andreproductive organs(R.O.):

Roots, stems and leaves are grouped as support organs while spikes as reproductive organs. The dry matter allocation to reproductive organs was less when compared to the supprt organs in all the forms exceptingC3, but higher as opposed to the roots. Also see the figure.

b)allocation of dry matter to the component parts of spike in percentage of its weight:

Reproductive allocations are recognized as 'primary'(seeds and embryo), and'secondary'(perianth, stalks, etc.). Between compact and lax groups, the former had lesserprimary allocation than the latter. As far assecondary allocation is concerned, no significant differences were observed among the compact and lax forms.

Table 1.The average percentage of dry matter and moisture content of all the forms of *D. aegyptium* in two peak periods. (Dry matter in gms. the remaining is moisture)

Form		August				October		
	root	shoot	leaf	inflorescence	root	shoot	leaf	inflorescence
C1	48.23	32.47	68.58	36.60	49.23	34.46	67.68	42.33
C2	57.99	26.02	47.07	42.77	59.23	28.22	49.77	48.83
C3	29.56	45.39	43.99	38.60	31.23	48.93	44.44	44.56
C4	44.73	40.62	35.82	42.93	48.33	42.67	39.41	49.51
C5	63.21	34.75	44.99	44.71	64.23	38.55	45.42	52.32
L1	47.18	44.50	67.88	46.51	48.60	45.45	68.78	48.62
L2	39.88	42.45	36.18	32.32	42.57	45.00	40.24	43.44
L3	52.73	38.75	36.53	37.32	54.82	41.92	41.48	50.51

Table 2: Allocation of dry weight to support organs(SO) and reproductive organs(RO) as percentage of net production and the primary and secondary reproductive allocations.

Plant part	C1	C2	C3	C4	C5	L1	L2	L3
roots	12.35	8.49	3.09	2.39	14.47	9.50	4.91	7.03
shoots	29.22	35.19	23.01	58.61	42.20	31.82	47.13	46.52
leaves	39.91	31.05	20.18	22.28	14.72	35.00	20.85	26.75
inflorescences	18.53	25.27	53.73	16.73	28.61	24.58	27.11	19.70
SO	81.48	74.73	46.27	83.28	71.39	75.42	72.89	80.30
RO	18.53	25.27	53.73	16.73	28.61	24.58	27.11	19.70
primary reproductive allocation	0.31	0.29	0.27	0.32	0.31	0.37	0.42	0.45
secondary reproductive allocation	0.13	0.09	0.11	0.14	0.14	0.11	0.13	0.17

Discussion

Since this species is an annual, energy allocation programme significantly differed quantitatively in the different forms studied. As the forms did not have wider spatial differences, environmental stress may not be the causative factor. Growth is dependent upon the availability of supplies to the growing organs, and correlations between the growth of different structures seem to be a function of competition for such essentials(Brouwer, 1962).Any environmental variation affecting the availability of such essentials as light, water, etc., would change the growth rates of different organs to varying degrees so that the overall pattern of dry matter distribution becomes altered. energy budget in terms of dry matter allocation is considered to be an integral part of autecological study(Barbour et al. 1980).The percentage of dry matter and moisture content for root and shoot differed among the different forms of *D.aegyptium* in accordance with their morphological variability.According to Boysen-Jenson (1932), dry matter is the key function of the plant.The dynamics of standing crop of the above-ground and the below-ground phytomass provide the necessary information about the structure and function of an ecosystem also.The percentages of dry matter and moisture content which are inversely proportional to each other in the two phases= vegetative and reproductive- differed very much among the forms.The higher dry matter values in the reproductive phase than in the vegetative phase can be ascribed mainly to the greater accumulation of assimilates in different parts of the plant.In the reproductive phase the inflorescences tended to bear more dry matter than the leaves. Jha and Sen(1981) made similar observations in *Cyperus rotundus.* As growth is dependent upon the availability of supplies, a change in the environment (light, water) changes the growth rates of different organs, altering dry matter distribution. During perennation, the stored energy may be variously packaged to produce many new individuals in the following season or to give one or few offspring. Theoretically an individual plant could show increased reproductive effort either by increasing its reproductive yield or by decreasing its vegetative weight or both, simultaneously.

Conclusion

It is evident from the study that this plant is allocating more energy to the vegetative parts. As the biomass produced is in higher quantities within few weeks it can be harvested and use for making best use of it by using it as a fodder for milk sorurce and can obtain cellulose and get glucose inturn the ethanol.

Note: This is a part of ecological study submitted for Ph. D. thesis.

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