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Economic Analysis in Different Spacings of Water Mimosa (*Neptunia prostrata* L.) Cultivation under Manipur Valley Condition

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A B S T R A C T

An experiment was conducted to study the economic analysis of cost and return of water mimosa under Manipur Valley condition. The present study was carried out at the experimental field of College of Agriculture, Central Agricultural University, Iroisemba, Imphal, Manipur during *kharif* season, 2018. The experiment was laid out in factorial randomized block design (FRBD) with 9 spacings, Non-root trimming and Root trimming methods with three replications. The primary data on cost of cultivation and return of water mimosa cultivation was collected and economically analyzed. The main finding on this study unveiled that the treatment S5T2 (4.5ft x 1.5ft with root trimming method) which is par with treatment S5T1 (4.5ft x 1.5ft without root trimming) has the maximum benefit of all other treatments.

Introduction

In Manipur, a large number of wild vegetables are found and well acclimatised since long time. Water mimosa (*Neptunia prostrata* L.) is one of them and local people prefer this vegetable very much due to its aroma and taste similar to tree bean (*Parkia roxburghii* G. Don). Tree bean is most prominent high value fruit vegetable (legume pod) desired by the local people. Its harvesting is ended during April. In the month of April, its cost is raised up to Rs. 25/pod. After April no fresh pods of tree bean are available. It is succeeded by water mimosa as the taste and aroma of the tree bean is similar to water mimosa. Perhaps, it may be due to they belong to the same family. During the month of May, the cost of water mimosa is Rs. 30 - 40/bundle comprising of 4 to 5 shoots or branches. Water mimosa is a wild aquatic legume herb locally known as *Ekaithabi*. It can be grown in ponds, small ditches, marshy and swampy areas where no other crops can be grown. Being high price vegetable, small and marginal farmers can earn a handsome amount of income by growing it. The North-eastern region of India particularly, Manipur

provides a favourable condition for mass propagation of water mimosa owing to its ample rainfall, humidity and moderate range of temperature (Singh, 2017).

Water mimosa is nutritionally high in Calcium. In a serving of 100 g edible portion of shoots contain Ca 387 mg, moisture 89.4 g, protein 6.4 g, fat 0.4 g, carbohydrates 0.8 g, fibre 1.8 g, ash 1.2 g, P 7 mg, Fe 5.3 mg, vitamin A 5155 IU, vitamin B_1 0.12 mg, vitamin B_2 0.14 mg, niacin 3.2 mg and vitamin C 1.8 mg and the energy value is 134 kJ/100 g (Anon., 1981). Juice of the stem and roots are used for medicinal purposes. The juice of the stem is squeezed into the ear to cure earache. The root is used as an external remedy for necrosis of the bones of the nose and hard palate. The root is used in the advanced stage of syphilis. Whole plant extract exhibited cytotoxic activity on neoplastic cell lines. Extract of the herb exhibited hepatoprotective activity (Tangkanakul *et al.,* 2006).In human when the imbalance between antioxidant defence system and oxidative stress is interrupted, it can cause cellular damage by initiating chemical chain reactions such as lipid peroxidation of cellular membranes, alteration of lipid–protein interaction, enzyme inactivation and DNA breakage, and in the end, to cause cellular dysfunction and cell death (Rahal *et al.,* 2014; Uttara *et al.,* 2009). Oxidative stress plays a critical role in the pathogenesis of various disorders and diseases such as carcinogenesis, coronary heart disease, atherosclerosis, diabetes, arthritis, Alzheimer's disease, cardiovascular disease, Parkinson's disease, and age-related disease (Rajendran *et al.,* 2014; Rochette *et al.,* 2013). The demand for natural antioxidants has recently increased because of toxicity, suspected carcinogenic potential and other adverse effects of synthetic antioxidants (Yoon *et al.,* 2010). Thus, there is growing interest in replacing synthetic antioxidants with natural resources, and much attention has been focused on natural antioxidants in maintaining the health of human body and preventing and treating diseases (Falowo *et al.,* 2014; Li *et al.,* 2014; Liu *et al.,* 2014). Water mimosa could be suggested as a potential natural source of antioxidant and antidiabetic compounds that can be used for the prevention or treatment of diabetes. The antioxidant in this plant has free radical scavenging capabilities (Lee *et al.,* 2014). Niacin plays an essential part in the metabolic process of living cells and is involved in both DNA repair and production of steroid hormones in the adrenal glands. In Manipur it is used as vegetable for preparation of *Eromba* (mashed vegetables with water), *Kanghou* (stir-fries), *Singju* (salad with fermented fish) and even as curries.

Water mimosa is cultivated in Manipur by the small and marginal farmers using their traditional knowledge for earning extra income but these traditional cultivation practices are not yet standardised. Therefore, the present investigation is considered essential to standardise the traditional cultivation practices to boost up the income of small and marginal farmers of Manipur valley. Perhaps the present study may be the first experiment on the cultivation aspect of research work in water mimosa.

Materials and Methods

The experiment was conducted at the experimental field of College of Agriculture, CAU, Imphal, Manipur during the *kharif* season, 2018. The soil was clay slightly loam with an average organic carbon contain 1.12 per cent. The average pH of the soil was 4.98 with a high quantity of available nitrogen and medium quantity of available phosphorus and potassium. The experiment was conducted in Factorial Randomised Block Design (FRBD) with three replications. In the experiment, for

collection of data on economic characters, single random sampling technique was followed and a single competitive plant was taken as a sample unit. A sample size of 10 plants from each plot was taken for each character parameter. The field was prepared with two ploughing to make the field into favourable condition for the cultivation. Chemical fertilizers @ 40kg N: 50kg P_2O_5: 40kg K_2O per hectare was applied as a basal dose. NEO Leaf granules, an organic Bio-stimulant, were applied @ 12kg/ha. Planting of water mimosa were done in such a way that the shoots are attached to the coconut coir rope in an alternate side in a specific spacing to the rope which floats on the surface of water with the support of used empty water bottles for floatation purpose. While tying the shoots to the rope, the shoot tips should always be kept at upward position on the surface of water not submerging into the water. The ropes are tight to the bamboo stakes in such a mechanism that the rope can be adjusted to the increasing or decreasing level of water.

Treatment details

Spacings

S1 – 3ft x 1ft S2 – 3ft x 1.5ft
S3 – 3ft x 2ft S4 – 4.5ft x 1ft
S5 – 4.5ft x 1.5ft S6 – 4.5ft x 2ft
S7 – 6ft x 1ft S8 – 6ft x 1.5ft
S9 – 6ft x 2ft

Root trimming

T1 – No root trimming
T2 – Root trimming

Treatment combinations

S1T1 – 3ft x 1ft + No root trimming
S2T1 – 3ft x 1.5ft + No root trimming
S3T1 – 3ft x 2ft + No root trimming
S4T1 – 4.5ft x 1ft + No root trimming
S5T1 – 4.5ft x 1.5ft + No root trimming
S6T1 – 4.5ft x 2ft + No root trimming
S7T1 – 6ft x 1ft + No root trimming
S8T1 – 6ft x 1.5ft + No root trimming
S9T1 – 6ft x 2ft + No root trimming
S1T2 – 3ft x 1ft + Root trimming
S2T2 – 3ft x 1.5ft + Root trimming
S3T2 – 3ft x 2ft + Root trimming
S4T2 – 4.5ft x 1ft + Root trimming
S5T2 – 4.5ft x 1.5ft + Root trimming
S6T2 – 4.5ft x 2ft + Root trimming
S7T2 – 6ft x 1ft + Root trimming
S8T2 – 6ft x 1.5ft + Root trimming
S9T2 – 6ft x 2ft + Root trimming

Economics

The economics or profit of water mimosa cultivation expressed in terms of hectare (P) was calculated by totalling all the sale prices of every harvest returns (R) and subtracting all the cost of cultivation (C) by using the formula: P=R-C.

Cost of cultivation: The total cost of cultivation of water mimosa included planting material, manure and fertilizers, labour, plant nutrients, etc.

Gross return: The gross return was calculated by the sale of harvested shoots for every treatment and was expressed in terms of hectare.

Net return: It was calculated by subtracting the total cost of cultivation from the gross return and expressed in rupee per hectare.

Benefit cost ratio: The benefit cost ratio (BCR) in terms of rupees was calculated by net return per hectare (NR) divided by cost of cultivation per hectare (CC), by using the formula: BCR=NR/CC

Results and Discussion

The data of yield is presented in Table 1 and illustrated graphically in Fig. 1. It was observed that the difference between highest and lowest values of yield is highly significant. In view of root management, the non-root trimming and root trimming method showed significant difference and in case of treatment combination it was insignificant.

Based upon the results obtained, it was observed that among the spacings S5(4.5ft x 1.5ft) has the highest value i.e. 10083 Kg/ha which is significantly higher than the remaining spacings and the lowest was observed in S9(6ft x 2ft) with a value of 5923 Kg/ha. Among the root management methods, maximum value was observed in root trimming method (T2) with a value of 8311 Kg/ha which is not significantly higher than non-root trimming method (T1) i.e. 8250 Kg/ha. Among the treatment combinations, the maximum value was observed in treatment S5T2 (4.5ft x 1.5ft with root trimming) with a value of 10149 Kg/ha which is significantly higher than the remaining treatments with the exception of treatment S5T1(4.5ft x 1.5ft without root trimming) i.e. 10018 Kg/ha.

Table.1 Yield (Kg) per hectare (Fresh) of shoots as influenced by different spacing and root trimming of water mimosa notation

SxT	S1	S2	S3	S4	S5	S6	S7	S8	S9	Mean
T1	8689	9426	7763	9439	**10018**	7697	7584	7727	**5906**	**8250**
T2	8857	9185	7707	9526	**10149**	7768	7943	7727	5940	**8311**
Mean	8773	9306	7735	9482	**10083**	7732	7763	7727	**5923**	

	S	T	SxT
SE d (±)	99	47	140
CD (P=0.05)	201	95	285

S1 – 3ft x 1ft
S2 – 3ft x 1.5ft
S3 – 3ft x 2ft
S4 – 4.5ft x 1ft
S5 – 4.5ft x 1.5ft
S6 – 4.5ft x 2ft
S7 – 6ft x 1ft
S8 – 6ft x 1.5ft
S9 – 6ft x 2ft
T1 – Non root trimming
T2 – Root trimming

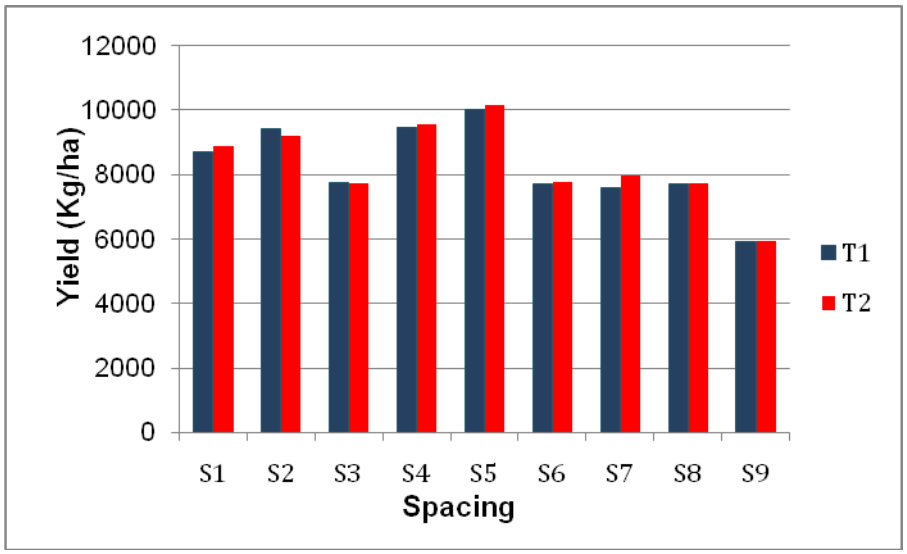
Table.2 Cost of cultivation of Water mimosa without the cost of nursery(cuttings) for 1 hectare

Sl. No.	Particulars	Price in Rupees (Rs./ha)
1.	Labour for 304 mandays @ Rs. 350 per day	106,400
2.	Ploughing (2 times)	6,400
3.	Manure and fertilizers	4,950
4.	PP chemicals (Organic)	4,000

Table.3 Economics of water mimosa as influenced by different spacing, Non root trimming and Root trimming methods

Treatments	Mean weight/shoot (g)	Plant population /ha	Total fresh yield of shoots for 7 harvests (Kg/ha)	Cost of Production (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C Ratio
S1T1	**44**	**27946**	**8689**	**231200**	868854	637654	**2.76**
S2T1	72	18631	9426	194311	942590	748278	3.85
S3T1	79	13973	7763	175866	776268	600402	3.41
S4T1	72	18631	9439	196078	943906	747829	3.81
S5T1	**115**	**12421**	**10018**	**169718**	**1001803**	**832085**	**4.90**
S6T1	118	9315	7697	158853	769728	610876	3.85
S7T1	78	13973	7584	175866	758359	582493	3.31
S8T1	119	9315	7727	158853	772747	613894	3.86
S9T1	120	7050	5906	149798	**590571**	**440773**	2.94
S1T2	45	27946	8857	233536	885734	652198	2.79
S2T2	70	18631	9185	196274	918512	722238	3.68
S3T2	79	13973	7707	177643	770711	593068	3.34
S4T2	73	18631	9526	196274	952582	756308	3.85
S5T2	**117**	**12421**	**10149**	**171433**	**1014886**	**843453**	**4.92**
S6T2	119	9315	7768	159012	776762	617750	3.88
S7T2	81	13973	7943	177643	794317	616674	3.47
S8T2	118	9315	7727	159012	772666	613654	3.86
S9T2	120	7050	5940	149948	593960	444012	2.96

Fig.1 Yield (Kg) per hectare (Fresh) of shoots as influenced by different spacing and root trimming of water mimosa



Economic Analysis

The lost or gain of crop production is judged by the analysis of economics and it is expressed in yield/ha. The cost of the nursery (cuttings) is Rs. 4/cutting. The other expenditure for cost of cultivation is given in the Table 2.

A perusal of the data in Table 3 shows the economic analysis of the production of water mimosa in different spacings.

The highest gross return, net return and benefit cost ratio are observed in treatment S5T2 (4.5ft x 1.5ft with root trimming method) i.e. Rs. 1,014,886/ha, Rs. 843,453/ha and 4.92 respectively followed by the treatment S5T1 (4.5ft x 1.5ft without root trimming) i.e. Rs. 1,001,803/ha, Rs. 832,085/ha and 4.90 respectively. The lowest gross return and net return are observed in treatment S9T1 (6ft x 2ft without root trimming) i.e. Rs. 590,571/ha and Rs. 440,773/ha respectively. The lowest benefit cost ratio is in S1T1 (3ft x 1ft without root trimming) i.e. 2.76.

In conclusion based upon the results obtained, it can be concluded that treatments S5T2 and S5T1 may be used because of their higher benefit cost ratio i.e. 4.92 and 4.90 respectively in comparison to other treatments. Therefore, the treatments S5T2 and S5T1 which have higher production may be recommended for growing water mimosa extensively in Manipur valley to maximise the production of water mimosa.

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