e jaggery units using other fuels like wood, ricultural residues and even old tyres etc.

The smoke emitted from the jaggery making rnace was sent out through a chimney at temperature of 350-375°C. The temperature flame during bagasse combustion was about 0°C maximum. The time of operation per tch was about 3.75 to 4.25 hours. The feeding bagasse was carried out by a labourer exclusively d each time about 0.2 kg was fed. Frequency manual feeding of bagasse was about 600 nes per hour which was cumbersome to the bourer.

The thermal efficiency of the traditional ggery making process was determined from e field data by calculating the heat energy put made through bagasse, heat utilized for evaporation of water from sugarcane juice d heat loss particularly through chimney.

eat energy input per batch = 8990 MJ

eat energy output required = 195.6 MJ r heating the juice

Total latent heat of vaporization of water = 1130 MJ

Total heat of evaporation required was = 1326 MJ

Thermal efficiency = Heat output/ Heat input

= (1326/8990) x100

The thermal efficiency of the existing furnace was found to be 14.75% which was low. The bagasse used was 3.85 kg/kg of jaggery manufactured. The study revealed that use of gasifiers for such thermal applications can lead to considerable increase in efficiency and development of a suitale bagasse based gasifier to generate producer gas for concentrating juice appears to be promising.

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Research Notes

Screening plant growth regulators (PGRs) and chemicals for the induction of early and vigourous rooting in broadcasted rice seedlings

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The widely practiced transplanting of rice seedlings in main field involves high cost of labour owing to labour scarcity and warrants timely operation especially when water sources are adequately available which ultimately results in over aging of the seedlings (Varughese et al. 1993. A suitable alternate method of planting the seedlings would be of great advantage to ride over the labour scarcity and to minimize the cost of cultivation. Planting rice seedling by means of broadcasting from a uniform height in a prepared main field would greatly facilitate timely planting (Matsushima, 1979). But such practice poses problems like poor rooting, poor establishment, late tillering and late maturity. As the initiation of rooting is delayed, seedlings result in poor establishment and delayed growth, which finally reflects on the yield. To overcome these problems, induction of early and vigorous rooting is essential. Root induction with the use of PGRs and other chemicals may enhance initial establishment, early anchorage, absorption of nutrients and ultimately growth, grain and straw yield (Henckel, 1964). In the study, the main objective was to screen the different chemicals and PGRs based on their effectiveness in the inducton of early and vigorous rooting in rice seedlings.

Experiments were carried out to find out the effectiveness of different PGRs and chemicals on root induction in broadcasted rice

Table 1. Effect of root dipping treatments with PGRs, chemicals and *Azospirillum* on per cent survival root length and shoot length

Treatments	Concentration (ppm)	Per cent survival	Shoot length (cm)	Root length (cm)
IBA	10	72.43 (90.84)	22.87	8.47
	25	98.22 (82.64)	25.84	10.23
NAA	10	89.72 (71.38)	19.07	8.07
	25	97.68 (81.50)	24.73	9.67
IAA	10	70.63 (57.16)	18.46	7.22
	25	68.18 (55.66)	17.62	6.84
Gibberellic acid	10	72.78 (58.56)	20.16	7.72
	25	75.13 (60.07)	21.27	8.43
Mepiquat chloride	10	97.63 (81.66)	24.53	10.15
	25	92.26 (73.90)	22.16	8.32
CCC	10	96.83 (80.17)	22.97	9.27
	25	89.48 (71.15)	19.86	7.98
Alar	10	90.52 (72.11)	18.93	7.61
	25	97.28 (80.80)	23.48	9.08
Triacontenol	10	73.47 (59.01)	17.19	7.12
	25	78.17 (62.15)	18.86	7.92
Salicylic acid	10	74.16 (59.45)	19.76	7.62
	25	72.32 (58.27)	18.12	7.06
	0.01	70.01 (56.80)	16.83	6.86
Brassinolide	0.1	75.62 (60.41)	19.24	7.73
Thiamine	10	96.76 (81.06)	23.72	10.03
	25	90.92 (72.71)	20.21	8.12
Ascorbic acid	10	97.08 (80.75)	24.02	9.92
	25	91.28 (72.83)	20.76	8.21
Glutamic acid	10	69.08 (56.24)	16.24	6.82
	25	74.68 (59.80)	17.61	7.51
Resorcinol	10	93.92 (75.99)	21.12	8.28
	25	97.56 (81.86)	25.23	10.09
Catechol	10	69.23 (56.31)	17.86	7.09
	25	65.20 (53.73)	16.23	6.12
$ZnSO_4$	1.0%	92.13 (73.78)	19.26	6.12
	2.5%	98.20 (82.21)	24.68	9.53
Control		69.78 (56.62)	18.76	6.28
SEd		3.53	2.01	0.683
CD (0.05)		7.25	4.120	1.400

Figures in the parentheses are transformed values.

dlings at the glasshouse, Dept. of Crop ysiology, TNAU, Coimbatore during *kharif* 98. The trial was conducted in rice seedlings DT 36) with ten PGRs and six chemicals ch at two concentrations along with control roadcasted seedlings without treatment). The atments were imposed as root dipping for minutes to the 25 day old seedlings. After treatment the seedlings were broadcasted the pots containing well-puddled soil. Ten ys after broadcasting observations were made per cent survival, root length and shoot gth and the values recorded were analysed tistically by using completely randomised block sign suggested by Panse and Sukhatme (1961).

Effectiveness of PGRs and chemicals to luce early and vigorous rooting in rice seedlings s evaluated in terms of morphological attributes ch as per cent survival, root length and shoot gth. Based on the observations made, it is erred that all the treatment showed numerically her per cent survival, root length and shoot gth over the control except catechol (15 d 25 ppm), which showed the values lower n the control, but PGRs like glutamic acid, ssinolide, triacontenol and IAA were registered nsignificant values for all these parameters lower concentrations. Many of the PGRs nd chemicals at both concentrations registered alues for per cent survival, root and shoot engths were on par with control. But IBA 25 ppm) registered the highest value for per ent survival (98.22) followed by $ZnSO_4$ - 5% (95.00) and NAA - 25 ppm (97.68).

Regarding root length, the root dipping teatment with IBA (25 ppm) was found to ecord significantly higher root length (10.23 m) overall other treatments followed by mepiquat hloride (10 ppm) (10.15 cm) and other treatments egistered significantly higher root length over ne control (6.28 cm) were thiamine (10 ppm), scorbic acid (10 ppm), $ZnSO_4$ (2.5%) NAA 25 ppm), CCC (10 ppm) and alar (25 ppm). his increase in root length with growth hormones vas due to increase in cell division and proliferation f root tissues (Das *et al.* 1989). The growth etardants also increased the root growth while urpassing the vegetative growth which was n confirmation with the results obtained in otton by Urwiller and Oosterhius (1986) and lso the increase in root length due to chemicals vas already confirmed by Sharma and Ravi 1993).

For the shoot length, the treatment with IBA-25 ppm recorded highest value (25.84 cm) followed by resorcinol-25 ppm (25.23 cm), NAA-25 ppm (24.73 cm) and $ZnSO_4$ - 2.5% (24.68 cm). Chhipa and Lal (1988) reported that IBA influenced the metabolic activity and the cell division in shoot apical meristem that induced the bud initiation. Mepiquat chloride (10 ppm) also increased the shoot length significantly over the control. These results were in line with the results of Zhang et al. (1995). The favourable influence of NAA was quite evident in as much as it being a growth stimulant interms of cell elongation (Sharma and Dey, 1986). At the vitamins at 10 ppm given as root dipping treatments increased the plant height significantly. Tonzig and Trezzi (1954) suggested that the enhanced growth of plants treated with vitamins might partly be due to the lowering of structural viscosity of protoplasm and thereby enlargement of cells.

$ZnSO_4$ (2.5%) also increased the shoot length due to the auxin inducement for cellular enlargement. These reults were in confirmation with the results of Srinivasan (1984).

From the results of the experiment, it was concluded that the growth regulators IBA (25 ppm), NAA (25 ppm) mepiquat chloride (10 ppm), CCC (10 ppm), alar (25 ppm) and chemicals thiamine (10 ppm), ascorbic acid (10 ppm), resorcinol (25 ppm) and $ZnSO_4$ (2.5%) were very effective for inducing early and vigorous rooting evaluated based on morphological attributes such as per cent survival, root and shoot length.

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Research Notes

Effect of saline water on growth, biochemical parameters and yield french bean

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Salinity plays an important role in survival and distribution of crops. Crops which are able to grow and yield under saline conditions show certain physiological attributes which make the crops adapted to salinity. Irrigation water with high chloride content causes considerable damage to plant growth and affects the crop yield. Beans are considered as sensitive crop and the performances of this crop under saline conditions are not encouraging. Earlier studies on the use of saline water high in chloride content is very much restricted to laboratory conditions (Gill and Sharma, 1999). However, studies under field conditions are scanty. The present field experiment, therefore, was conducted to study the effect of saline water with high chloride content on the growth, biochemicals and yield of french bean (*Phaseolus vulgaris* Linn.)

Experiment was conducted in a farmer's field at Oddanchatram in Dindigul districts of Tamil Nadu. French bean (Local variety) was raised in red sandy soil by following normal package of practices during 1996-1997. A field which was irrigated with saline water has been identified and simultaneously another field the same location with normal water has al been selected to serve as control. Crops we raised both with normal water as well as wi saline water high in chloride content. The irrigatio water was analyzed for chemical constituen and data are furnished in Table 1. The thir leaf from the top of the main shoot at floweri phase was used for the analysis of chlorophy and carotenoid content (Arnon 1949), Prolin (Bates *et al.* 1973) nitrate reduchese activit (Wrag and Filner, 1970) and chloride conte (Chopra and Kanwar, 1991) at Horticultur College and Research Institute, Periyakulam The green pods were harvested at vegetabl stage and the cumulative yield was recorded The percentage of Chloride injury was calculate based on the visual symptom of the leaf bur injury (Somani, 1991). The data were subjecte to statistical analysis.

Considerable reduction in plant growth and yield was observed in french bean due to irrigation with saline water (Table 2). Saline water reduced the plant height to 55 cm as