AN OVERVIEW

The literature on the emergence and spread of new agricultural technology and its effects on growth and distribution of income and employment across regions and size groups of farmers is quite extensive and is burgeoning. It is generally held that the new technology is land augmenting and labour displacing, only if mechanization predominates. If the new technology which is described as scale-neutral but not resource-neutral is widely adopted, regional and social inequalities get exacerbated leading to social tensions of varying magnitude. The literature on the green revolution, with a few exceptions, has established the foregoing propositions. However, general debates are raised on the rationality of new technology
in the context of labour surplus economies like India, even though its adoption is justified on the ground of accelerating the rate of growth on the agricultural front.

**YIELD AND EMPLOYMENT EFFECTS OF NEW TECHNOLOGY IN INDIA**

The green revolution in India has so far been largely confined to wheat and to a lesser extent on rice, while the improvement in coarse grain has been marginal. The result has been the emergence of an unbalanced cropping pattern. Infrastructure conditions helped in bringing about the wheat revolution along with human efforts, public and private. No such concentrated effort has so far been made regarding crops which cater to a more nutritious diet. If land saving and labour using innovations could be brought about through a balanced package of high-pay off inputs coupled with infrastructure facilities and incentives, then there are reasons to expect an accelerated adoption of HYV technology across social groups and regions resulting in increasing social harmony as well as realisation of potential output as against the emerging third generation problems of social and regional inequalities and consequent social tensions.

**AGRICULTURAL ECONOMY OF CHITTOOR DISTRICT**

Chittoor district located in the drought-prone area of Rayalaseema, is considered to be one of the agriculturally developed districts on the basis of several indicators
The area under HYVs for paddy (148 per cent), jowar (94 per cent) and bajra (2680 per cent) has gone up during 1970-71 to 1989-90. The proportion of area under food crops has declined from 59 to 44 per cent from 1970-71 to 1987-88. This is a measure, though imperfect, of commercialisation of agriculture in the district. The distribution of HYVs of seed for paddy has gone up by two and half times and bajra three and half times during 1970-71 and 1988-89; the distribution of chemical fertilizers has tended to decline during the same period; and area treated with plant protection measures has gone up from 70 per cent in 1973-74 to 101 per cent in 1985-86. Between 1966 and 1987 farm equipment exhibited expansion of varying magnitude, indicating mechanization led green revolution in the district. 80 per cent of small farmers account for 42 per cent of the area, 40 per cent of net area sown and 44 per cent of net area irrigated. There is a positive and significant relationship between farm-size and intensity of cropping. Yield of paddy has gone up by 40 per cent during 1969-71 to 1987-89. However, the yield of paddy in Chittoor district is lower than that of Rayalaseema region and Andhra Pradesh state. Groundnut yield is characterised by instability and the mean yield of district is marginally higher than that of Rayalaseema and Andhra Pradesh. In Chittoor, 70 per cent of the work force is in agricultural sector as
in the case of the country. Given the institutional framework and technological change led by mechanisation, the distribution of gains from HYV technology in terms of yield and employment are bound to be unequal.

**YIELD EFFECTS OF NEW TECHNOLOGY**

Yield effects of HYV technology is studied using the field data collected from six villages spread over six mandals covering 255 households. Compared with local varieties the yield of HYVs of paddy is higher by 12 per cent in Division I, 2 per cent in Division II, 32 per cent in Division III and 24 per cent for all the divisions. The difference between local and HYVs of paddy in respect of mean yield is highly significant for Divisions II, III and all divisions, while it is significant at 5 per cent level in Division I. Cobb-Douglas production function reveals that effect of seeds, fertilizers, manures and pesticides and human labour on output is significant for both local and HYV technologies. In Divisions II and III the influence of employment is significant under both the technologies. As revealed by co-efficient of multiple determination ($R^2$) the five variables viz., seeds, fertilizers and manures, employment, proportion of paddy area and proportion of irrigated area to total area explain 98 per cent of variation under local technology and 99 per cent under HYV technology in Division I, 99.1 per cent variation under
the former and 99.7 per cent variation under the latter and
99.7 per cent variation in the case of local varieties in
Division II, and 99.3 per cent of variation in respect of
HYVs in Division III. The variables explain 98 per cent
of variation in gross output under both HYV and local
technologies in all the Divisions.

In the case of groundnut the yield of HYVs is higher
by 18 per cent in Division I, 28 per cent in Division II,
53 per cent in Division III and 28 per cent for all Divi-
sions. The difference in mean yield of local and HYV
technologies are significant in Divisions I and III and
also in all Divisions. Hence, we reject the null hypothesis
viz., there is no significant difference between local and
HYVs in respect of yield rates of paddy and groundnut.
 Production function analysis for groundnut reveals that in
all the Divisions only employment has significant effect
on output under both technologies. The co-efficient ($R^2$)
of multiple determination reveals that 99 per cent of the
variation in output for both local and HYV technologies
in Division I, 98 per cent and 97 per cent for local and
HYVs in Division II, 98.9 per cent and 99.8 per cent in
Division III, and 97.9 per cent and 97.6 per cent for all
Divisions is explained by independent variables.

**EMPLOYMENT EFFECTS PER HECTARE**

The employment effects of new technology on paddy and
groundnut are presented in Table 7.1.
<table>
<thead>
<tr>
<th>Operation</th>
<th>Paddy</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$D_1$</td>
<td>$D_2$</td>
<td>$D_3$</td>
<td>$AD$</td>
<td>$D_1$</td>
<td>$D_2$</td>
<td>$D_3$</td>
<td>$AD$</td>
<td></td>
</tr>
<tr>
<td>Land preparation</td>
<td>102</td>
<td>130</td>
<td>166</td>
<td>113</td>
<td>58</td>
<td>134</td>
<td>91</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Manuring and fertilizers/seeding</td>
<td>348</td>
<td>327</td>
<td>284</td>
<td>304</td>
<td>217</td>
<td>295</td>
<td>120</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>Sowing and transplantation</td>
<td>171</td>
<td>181</td>
<td>164</td>
<td>173</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Weeding</td>
<td>280</td>
<td>294</td>
<td>326</td>
<td>322</td>
<td>115</td>
<td>119</td>
<td>114</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>Pesticides</td>
<td>176</td>
<td>365</td>
<td>331</td>
<td>309</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>243</td>
<td>212</td>
<td>395</td>
<td>298</td>
<td>255</td>
<td>302</td>
<td>139</td>
<td>229</td>
<td></td>
</tr>
<tr>
<td>Harvesting/picking</td>
<td>123</td>
<td>97</td>
<td>106</td>
<td>108</td>
<td>114</td>
<td>118</td>
<td>120</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Threshing and winnowing/post-picking operations</td>
<td>111</td>
<td>138</td>
<td>160</td>
<td>140</td>
<td>158</td>
<td>102</td>
<td>114</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>166</td>
<td>182</td>
<td>193</td>
<td>187</td>
<td>114</td>
<td>140</td>
<td>116</td>
<td>123</td>
<td></td>
</tr>
</tbody>
</table>

Note: *$D_1$ = Division I, $D_2$ = Division II, $D_3$ = Division III and $AD$ = All Divisions.*

Source: Tables 5.1 and 5.4.
Our findings indicate positive employment effects of new technology for both paddy and groundnut in respect of all the operations in all the Divisions, exceptions being harvesting in the case of paddy in Division II and land preparation in respect of groundnut in Divisions I and II and all Divisions.

Student 't' test indicates that total employment per hectare under HYVs is significantly higher than that under local varieties for both paddy and groundnut.

Production function results indicate that under both the technologies the value of seeds has a significant effect on employment in all the Divisions. As revealed by $R^2$, 94 to 99 per cent variation in employment is explained by independent variables in different Divisions.

EMPLOYMENT EFFECTS PER QUINTAL

Our findings related to employment effects per unit of output are shown in Table 7.2.
Table 7.2
INDICES OF EMPLOYMENT EFFECTS PER QUINTAL OF HYVs
(local = 100)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Faddy</th>
<th>Groundnut</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D₁</td>
<td>D₂</td>
</tr>
<tr>
<td>Land preparation</td>
<td>100</td>
<td>125</td>
</tr>
<tr>
<td>Manuring and fertilizers/seeding</td>
<td>350</td>
<td>300</td>
</tr>
<tr>
<td>Sowing and transplantation</td>
<td>143</td>
<td>183</td>
</tr>
<tr>
<td>Weeding</td>
<td>225</td>
<td>250</td>
</tr>
<tr>
<td>Pesticides</td>
<td>150</td>
<td>350</td>
</tr>
<tr>
<td>Irrigation</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>Harvesting/picking</td>
<td>111</td>
<td>100</td>
</tr>
<tr>
<td>Threshing and winnowing/post-picking operations</td>
<td>100</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>146</td>
<td>171</td>
</tr>
</tbody>
</table>

Note: *D₁ = Division I, D₂ = Division II, D₃ = Division III and AD = All Divisions.

Source: Tables 5.7 and 5.9.
In the case of paddy, for all the operations the employment effects are positive, the exceptions being land preparation and harvesting in Division III and all Divisions. In respect of groundnut, we notice positive effects only for manuring and fertilizers, seedling and irrigation in all the Divisions, land preparation in Division II, weeding, picking and post-picking operations in Division III. In all other cases, we notice negative effects.

**FARM SIZE, YIELD AND EMPLOYMENT**

Small and marginal farmers account for 81 per cent of holdings and 57 per cent of operated area in Division I, 72 per cent of holdings and 39 per cent of operated area in Division II, 72 per cent of holdings and 45 per cent of operated area in Division III and 75 per cent of holding and 48 per cent of the land for all Divisions. The corresponding percentages for large farmers are 4 and 13 in Division I, 9 and 25 in Division III, and 6 and 20 in Division II as well as all Divisions taken together. Our findings indicate a positive relation between farm size and area irrigated, the exception being the lower medium farms.

**YIELD**

The yield per hectare of HYVs of paddy is higher than that of local varieties in all the size-classes in all the
Divisions. Yield per hectare is falling as farm size increases in Division I and it is increasing in Divisions II and III. If all the Divisions taken together, there is no consistency in the yield of local varieties. The relation between farm size and yield is positive and highly significant in all the Divisions under both local and HYVs.

In the case of groundnut, the yield per hectare has increased with farm size under both local and HYVs in Division I and II and there is no consistency in Division III in respect of HYVs. The nexus between farm size and yield is positive for local varieties in all the divisions and for HYVs it is positive only in Division I.

LABOUR INPUT PER UNIT OF LAND

Labour input per hectare in the case of HYVs is higher in the case of all operations except, harvesting, threshing, winnowing and land preparation in all the Divisions. Regarding size-employment relations there is no consistency among different size groups (with few exceptions). Our results indicate a positive and significant relation between farm size and labour input per hectare for both local and HYVs for all the Divisions. In the case of groundnut also we notice a similar situation.
LABOUR INPUT PER QUINTAL OF OUTPUT

In the case of labour input per quintal of paddy HYV technology requires higher dosage of labour when compared to local varieties in all the Divisions and also in all size groups. However, there is no consistency across size groups.

Our results suggest a positive relation between farm size and labour output per quintal under both HYV and local technologies in all the Divisions and the result is significant in all cases, the exceptions being the HYVs in Divisions II and III. A similar situation is found in the case of groundnut.

POLICY IMPLICATIONS

The foregoing analysis indicates that HYV technology in respect of paddy and groundnut is land-augmenting and in most of the cases labour-absorbing measure either in terms of unit of land or output. The nexus between farm size and yield, and employment in respect of paddy and groundnut is not clearly emerging and therefore no firm conclusions can be drawn in this aspect for the purposes of policy formulation. However, the yield and employment effects of the new technology are favourable from the point of view of growth and employment generation and hence public policy in the district may be directed to encourage the spread of HYV technology to realise the production potential and provide greater employment opportunities.