Concept and Experiences on Genetic of Rice Bean

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Introduction

- Ricebean [(Vigna umbellata (thumb) Ohwi and Ohashi) 
  *syn Phaseolus pubescens*
  *syn Phaseolus calcaratus*]
- $2n=2x=22$
- It is an important grain legume uses as pulses and vegetable in mid hills.
- It contains 22.0, 0.6, 59.0 and 5.2 percent of protein, fat, carbohydrates and fibre, respectively
- It is also rich in calcium, iron and phosphorus.
It has comparatively high quantity of amino acids, methionine and tryptophan.

It is grown successfully where Green gram and black gram can not be grown.

It is highly photosensitive short-day crop so its cultivation is restricted to rainy season in hills.

Photo insensitive variety can be successfully grown in spring.
Photo insensitive lines when planted in spring it took 3 to 18 days more in flower initiation indicated that thermo sensitive nature of the crops. (Gupta, S et.al 2005)

This is moderately resistant to MYMV and highly tolerant to bruchid infestation.

The rice bean has many varieties, varying in seed color and size and time taken for maturity.
Crossing behavior and inheritance

- The flowers of rice bean are self fertilized but natural out crossing 27 to 81% in 86 to 100% lines.
- Monogenic inheritance is reported in seedling color.
- Earliness is controlled by dominance gene.
- Stem colour in seedling (Rs-rs) and pigmentation in flower bud (Psb-psb) were monogenetically inherited (Das and Dana, 1980).
- Flower colour standard and wing (Lya-lya), Days to flower (E-e) and helium ring color (Ph-ph) are monogenetically inherited (Das and Dana, 1981b).
- Stem color, pod color and seed coat base and mosaic are also independent. (Das and Dana, 1981b)
They proposed the following gene symbols: \( T^{st} \), straw colour; \( t^{sg} \), sap green colour; \( t^{sb} \), garnet brown colour; \( M^d \), dense mosaic spotting; \( M^l \), light mosaic spotting; and \( m \), no mosaic spotting.
- Dominance is strawcolor>sap greencolor>garnet brown
- Dense mosaic>light mosaic and no mosaic
- Pod color was controlled by two non allele interacting genes (Ab-ab and Lp-lp) resulting in 13:3 ratio.
• Grain yield has significant negative correlation with DF, DM, Plant height, and 100 seed wt

• DF, DM, PH and 100 sw were significant positive correlated with each other.

• Path analysis showed that DF has high positive direct effect but DM has direct negative effect on seed yield.
revealed that 100 seed wt, seed yield exhibited high estimates of phenotypic and genotypic coefficients of variance (>50%) along with high heritability > 95% having moderate genetic advance (Kishore, N et al, 2005)

High heritability of DF, DM, PH
Objectives

• To understand the breeding behaviors of the crop.
• To create the variability.
Materials and method

- Four Rice bean accessions were selected on the basis of previous year performance.
- Reciprocal crosses of all four lines were made.
- Crops were planted in raised bed due to rainy season in AGD, Khumaltar on 5th August, 2008.
- Crops were covered with Net.
- Emasculation was done in morning and pollination on afternoon.
## Selected lines for crossing

<table>
<thead>
<tr>
<th>Accession</th>
<th>Collection</th>
<th>Plant habits</th>
<th>Seed colour</th>
<th>DF</th>
<th>DM</th>
<th>Pod length</th>
<th>No of seeds/pod</th>
<th>100 sw</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGR 882</td>
<td>Bajhang</td>
<td>Determinate</td>
<td>mottled</td>
<td>82</td>
<td>136</td>
<td>6.1</td>
<td>10</td>
<td>20.6</td>
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<td>Determinate</td>
<td>Mottled</td>
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<td>153</td>
<td>7.2</td>
<td>6</td>
<td>7</td>
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<td>Dang</td>
<td>Indeterminate</td>
<td>Yellow</td>
<td>96</td>
<td>136</td>
<td>6.4</td>
<td>8</td>
<td>15.6</td>
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<tr>
<td>RGR 11</td>
<td>Gulmi</td>
<td>Indeterminate</td>
<td>Red</td>
<td>96</td>
<td>159</td>
<td>8.5</td>
<td>9</td>
<td>14.1</td>
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## Crossing Results

<table>
<thead>
<tr>
<th>Crosses</th>
<th>Total</th>
<th>Female</th>
<th>Male</th>
<th>F1 9pods&amp;seeds)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mottled</td>
<td></td>
</tr>
<tr>
<td>NRGR7882x LRGR 91</td>
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<td>Yellow</td>
<td>-</td>
<td>7(30)</td>
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<td>Red</td>
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<td>3(12)</td>
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<tr>
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<td>Mottled</td>
<td>Yellow</td>
<td>15(40)</td>
<td>-</td>
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<tr>
<td>NRGR9391x LRGR111</td>
<td>3</td>
<td>Mottled</td>
<td>Red</td>
<td>3(8)</td>
<td>-</td>
</tr>
<tr>
<td>Crosses</td>
<td>Total</td>
<td>Female</td>
<td>Male</td>
<td>F1 9pods &amp; seeds</td>
<td>Remarks</td>
</tr>
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<td></td>
<td></td>
<td>Mottled</td>
<td>Red</td>
</tr>
<tr>
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<td>1</td>
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<td>Mottled</td>
<td>-</td>
<td>-</td>
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<tr>
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<tr>
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<td>Red</td>
<td>Mottled</td>
<td>-</td>
<td>15(40)</td>
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<td>Mottled</td>
<td>-</td>
<td>6 dark brown(10)</td>
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<td>Cr</td>
<td>Black</td>
<td>Maroon</td>
<td>Brown</td>
<td>Yellow</td>
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<td>Brown</td>
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<tr>
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<td>14</td>
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<tr>
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<td>0</td>
<td>5</td>
</tr>
<tr>
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<td>Maroon</td>
<td>Mottled</td>
<td>Black</td>
<td>Total</td>
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<tr>
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<td>LRGR111</td>
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</table>
## LRGR91 X LRGR00111

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Cr</th>
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<th>Maroon</th>
<th>Brown</th>
<th>Total</th>
<th>Rem</th>
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<tbody>
<tr>
<td>LRGR91</td>
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<td>Pure</td>
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<td>1</td>
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<td>86</td>
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<td>100</td>
<td>Mixed</td>
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</tbody>
</table>
LRGR91 XLRGR111

![Bar chart showing percentage of different colors for LRGR91 and LRGR111, with additional categories for LRGR91 (Mix) and LRGR111 (Mix).](chart.png)
Conclusions

- Further studies is needed to confirm either parents are homozygous or not?
- Three or four markers should be identified and taken to further studies.
- Population will be planted at Rampur to conclude.
NPGR 7882 (Mottled)

LRGR 111 (Red)
NPGR 7882 (Mottled)

LRGR (Yellow)
NPGR 9391 (Mottled)

LRGR 91 (Yellow)
NPGR 9391 (Mottled)

LRGR 111 (Red)
LRGR 111 (Red)

NPGR 9391 (Mottled)
LRGR 117 (DRK Brown)  NPGR 9391 (Mottled)