**ANNUAL REPORT -2014-15**

**104-11 Enhancing Resource Use Efficiency in Castor based cropping systems**

**Experiment 1: Studies on crop-weather relationships in *rabi* castor as influenced by optimum sowing schedule and genotypes**

Reduction (43-59%) in drymatter accumulation with progressive delay in sowing and the lowest accumulation was noticed in the crop sown on 1st November. Among different sowing schedules, sowing during 1st Oct registered the highest seed yield (2671 kg/ha). With delay in sowing from Oct 1 to Oct 15 (15 days), Nov 1 (30 days) yield of castor was declined by 27.6% and 37.6% respectively. The Growing Degree Days (3573 0c), Helio ThermalUnits (29153 degreedays-hours), Photo-Thermal Units (41136 degree days hours) and Heat Use Efficiency (0748 kg ha-1 degree days) accumulated was highest in the crop sown on Oct 1st. Ten genotypes of castor (7 hybrids + 3 varieties) presently in the seed chain were evaluated for their suitability in *rabi* season in large plots. Among different sowing schedules, sowing during 1st Oct registered the highest seed yield (2671 kg/ha). Significantly the highest seed yield was recorded in DCH-519 (2921 kg/ha) and closely followed by GCH-7 (2617 kg/ha) and DCH-177 (2456 kg/ha). Among varieties DCS-107 performed superior (2386 kg/ha) over 48-1 and GC-3.The hybrids *viz.,* PCH-111, YRCH-1 were found to be susceptible to wilt.

**Table 1: Performance of castor hybrids as influenced by four sowing schedules during *rabi* season**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sowing schedule** | **Seed yield (kg/ha)** | | | |
| GCH-7 | DCH-519 | DCH-177 | Mean |
| 3rd week of Sept (21st Sept) | 2206 | 2439 | 2196 | 2280 |
| 1st week of October (1 st Oct) | 1896 | 2447 | 2077 | 2140 |
| 3rd week of October(15th Oct) | 1850 | 2189 | 1750 | 1930 |
| 1st week of November (1st Nov) | 1409 | 1567 | 1221 | 1399 |
|  | 1840 | 2160 | 1811 | 1937 |
|  | SEm ± | CD  (P=0.05) | CV (%) |  |
|  | 108 | 373 | 16.73 |  |
|  | 83.0 | 248.7 |  |  |
|  | 166 | 497 |  |  |
|  | 173 | 519 |  |  |

**Table 2: Oil content (%) of *rabi* castor as influenced by genotypes and sowing schedules**

|  |  |  |
| --- | --- | --- |
| Sowing Schedule | **Primary** | **Secondary** |
| 3rd week of Sept | 47.09 | 47.55 |
| 1st week of October | 47.83 | 47.99 |
| 3rd week of October | 47.96 | 47.70 |
| 1st week of November | 45.28 | 47.16 |
| SEm ± | 0.188 | 0.287 |
| CD (P=0.05) | 0.564 | NS |
| Genotypes |  |  |
| DCH-519 | 46.74 | 46.75 |
| GCH-7 | 47.10 | 47.72 |
| DCH177 | 47.28 | 48.35 |
| SEm ± | 0.412 | 0.146 |
| CD (P=0.05) | NS | 0.437 |

**Table 3: Growing degree days, Helios thermal unit (HTU) photo-thermal unit (PTU) and Heat use efficiency (HUE) of castor hybrids as influenced by staggered sowings during *rabi***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sowing Schedule | GDD (0C) | HTU  degree-days hours | PTU  degree-days hours | HUE  kg ha-1 degrees-day | Duration  (days) |
| 3rd week of Sept (21st Sept) | 3090 | 24537 | 35158 | 0.737 | 176 |
| 1st week of October (1 st Oct) | 2886 | 23252 | 32720 | 0.741 | 166 |
| 3rd week of October(15th Oct) | 2672 | 21941 | 30178 | 0.721 | 154 |
| 1st week of November (1st Nov) | 2621 | 21663 | 29663 | 0.533 | 149 |
| Mean | 2817 | 22848 | 31930 | 0.683 | 184 |

**Experiment 2: Performance of *rabi* castor to drip irrigation/fertigation**

Drip-fertigation of *rabi* castor at 0.8 Epanalong with supply of full amount of water soluble N and K through fertigation resulted in significantly higher castor seed yield (3786 kg/ha) and oil yield (1712 kg/ha) compared to surface irrigation control. This was on par with scheduling irrigation through drip at 0.6 Epanthrough fertigation. Drip irrigation resulted in high water-use efficiency (3.32 to 6.45 kg/ha-mm) and highest water productivity ranging from (0.3324 to 0.6445 kg/m3) comparison to conventional surface irrigation treatment (0.2910 kg/m3).

**Table 4 : Performance of *rabi* castor under drip irrigation/fertigation**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tr |  | Pl ht (cm) | Spike length (cm) | Branches  (no.) | Nodes  (no) | Primary  100 seed | Capsules/plant | Days to  50% flowering |
| I1 | Drip irrigation at 0.6Epan +50% N & K through fertigation | 148 | 77.1 | 8.3 | 14.3 | 28.3 | 1344 | 52 |
| I2 | Drip irrigation at 0.6Epan +80% N & K through fertigation | 160 | 69 | 8.7 | 14.0 | 29.0 | 1520 | 50 |
| I3 | Drip irrigation at 0.6Epan +100% N & K through fertigation | 166 | 74.1 | 9.5 | 14.5 | 30.1 | 1898 | 49 |
| I4 | Drip irrigation at 0.8Epan +50% N & K through fertigation | 154 | 76.2 | 8.5 | 13.9 | 29.0 | 1418 | 52 |
| I5 | Drip irrigation at 0.8Epan +80% N & K through fertigation | 170 | 73.4 | 9.4 | 14.0 | 30.2 | 1832 | 49 |
| I6 | Drip irrigation at 0.8Epan +100% N & K through fertigation | 174 | 80.2 | 10.1 | 14.7 | 31.2 | 1938 | 49 |
| I7 | Drip irrigation at 0.8Epan +80% N & K through soil application | 162 | 77.1 | 8.9 | 14.0 | 30.8 | 1847 | 50 |
| I8 | Surface check basin irrigation at 0.8 IW/CPE | 114 | 65.7 | 7.1 | 13.8 | 29 | 1304 | 52 |
|  | S Em ± | 3.71 | 2.06 | 0.436 | 0.71 | 1.46 | 57.3 | 0.898 |
|  | CD (P=0.05) | 11.3 | 6.26 | 1.32 | NS | NS | 174 | NS |
|  |  |  |  |  |  |  |  |  |

**Table 4 (a) : Performance of *rabi* castor under drip irrigation/fertigation**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Tr |  | Seed yield (kg/ha) | Stalk  Yield  (kg/ha) | Oil content  (%) | Oil yield (kg/ha) | Water Use Efficiency (Kg/ha-mm) | Water productivity (kg/m3) |
| I1 | Drip irrigation at 0.6Epan +50% N & K through fertigation | 2324 | 4629 | 47.17 | 1097 | 4.38 | 0.438 |
| I2 | Drip irrigation at 0.6Epan +80% N & K through fertigation | 2646 | 5148 | 46.49 | 1231 | 4.99 | 0.499 |
| I3 | Drip irrigation at 0.6Epan +100% N & K through fertigation | 3328 | 5467 | 47.19 | 1570 | 6.28 | 0.628 |
| I4 | Drip irrigation at 0.8Epan +50% N & K through fertigation | 2721 | 4734 | 46.24 | 1258 | 3.93 | 0.393 |
| I5 | Drip irrigation at 0.8Epan +80% N & K through fertigation | 2893 | 5264 | 47.11 | 1363 | 4.18 | 0.418 |
| I6 | Drip irrigation at 0.8Epan +100% N & K through fertigation | 3467 | 6123 | 46.18 | 1599 | 5.01 | 0.501 |
| I7 | Drip irrigation at 0.8Epan +80% N & K through soil application | 2980 | 5945 | 45.69 | 1360 | 4.31 | 0.431 |
| I8 | Surface check basin irrigation at 0.8 IW/CPE | 2232 | 4432 | 46.36 | 1035 | 2.37 | 0.237 |
|  | S Em | 139 | 224 | 0.417 | 61.34 |  |  |
|  | CD P=0.05 | 423 | 680 | NS | 186.06 |  |  |

**Experiment 3:**

**Evaluation of castor genotypes for their suitability in *rabi* season**

Among castor hybrids, the highest seed yield was recorded in DCH-519 (3217 kg/ha) and closely follwed by GCH-7 (2817kg/ha). The wilt incidence in different genotypes varied between 1.04 -94.5%

**Table 5: Wilt incidence (%) in castor hybrids as influenced castor genotypes during *rabi***

|  |  |  |
| --- | --- | --- |
| Genotype | Wilt incidence (%) | Fusarium population (CFU count)  Colony count/g/mi |
| 48-1 | 1.04 | 4x103 |
| DCS-107 | 3.17 | 2.3x103 |
| DCH-519 | 9.94 | 2.0x103 |
| GCH-7 | 21.5 | 5.67x103 |
| GC-3 | 48.4 | 16x103 |
| DCH-177 | 55.0 | 4x103 |
| PCH-111 | 78.9 | 12.3x103 |
| GCH-4 | 84.6 | 3.3x103 |
| YRCH-1 | 94.5 | 10x103 |

**Experiment 4:**

**Moisture x nutrient interaction in castor – sorghum cropping system in Alfisols under rainfed condition**

Drought situation prevailed during 2nd FN of June and July. Total rainfall received for sorghum was 364mm and for castor it was 391mm. Under drought situation receiving 65% normal total rainfall, both sorghum and castor crops were affected in initial period up to flowering. Applying FYM for 25%N along with 75%NPK recorded significantly highest seed yield of sorghum (4338kg/ha) and castor (2266kg/ha) compared to either N alone or NP or NPK without FYM. The dry weight of sorghum stover was highest with 100% NPK+5t FYM/ha. Days for 50% flowering in sorghum and castor were significantly delayed with no manure or fertilizer application. The soil moisture content in the treatment receiving FYM was higher at all stages of crop growth both at 0-15cm and 15-30cm depths.

**Treatment details**

|  |  |  |
| --- | --- | --- |
| Tr. No. | **Treatment** | |
| **Castor** | **Sorghum** |
| 1. | N (60kg/ha) | N (60kg/ha) |
| 2. | NP (60:40:0) | NP (60:30:0) |
| 3. | NPK (60:40:30) | NPK (60:30:30) |
| 4. | 50% NPK (30:20:15) | 50% NPK (30:15:15) |
| 5. | 75% NPK + 25% N (FYM) (45:30:22) (15N) | 75% NPK + 25% N (FYM) (45:22:22) (15N) |
| 6. | NPK (P through SSP) | NPK (P through SSP) |
| 7. | NPK (60:40:30) | NPK (60:30:30) + 10kg Zn/ha (ZnO) |
| 8. | NPK + 5t FYM/ha | NPK + + 5t FYM/ha |
| 9. | No manure/fertilizer | No manure/fertilizer |

Date of sowing: 12-6-2015

Date of harvesting: Sorghum: 29-9-2015 Castor: 13-11-2015

**F1: Performance of SORGHUM in Sorghum – castor cropping system: Sorghum *kharif* 2015 – Rainfed Alfisols**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Seed yield (kg/ha)** | **Chaff yield (kg/ha)** | **Empty earhead weight (kg/ha)** | **Dry weight of stover (kg/ha)** | **Total biological yield (kg/ha)** | **Fresh weight of Fodder (kg/ha)** | **1000 seed weight (g)** | **Days to 50% flowering** | **Harvest Index (%)** |
| 1 | 2526 | 141 | 656 | 3809 | 7132 | 14697 | 21.8 | 85.3 | 35.3 |
| 2 | 3838 | 125 | 684 | 4562 | 9209 | 16109 | 24.4 | 75.7 | 41.6 |
| 3 | 3528 | 146 | 826 | 4635 | 9135 | 16967 | 24.1 | 75.3 | 38.6 |
| 4 | 2139 | 111 | 555 | 3884 | 6690 | 14108 | 22.4 | 80.7 | 31.7 |
| 5 | 4338 | 155 | 790 | 4947 | 10229 | 17721 | 25.3 | 74.7 | 42.4 |
| 6 | 3313 | 145 | 669 | 4070 | 8197 | 15061 | 23.1 | 76.3 | 40.3 |
| 7 | 3644 | 138 | 801 | 4542 | 9125 | 17215 | 24.0 | 75.3 | 39.8 |
| 8 | 4296 | 133 | 755 | 5230 | 10415 | 17297 | 26.5 | 74.0 | 41.2 |
| 9 | 1088 | 159 | 334 | 3417 | 4998 | 12908 | 20.5 | 85.7 | 21.1 |
| Gen Mean | 3190 | 139 | 675 | 4344 | 8348 | 15787 | 23.6 | 78.1 | 36.9 |
| SEm± | 219.4 | - | 114.8 | 218.3 | 440.4 | 646.6 | 0.7 | 1.8 | 1.3 |
| CD (P=0.05) | 658 | NS | NS | 654 | 1320 | 1938 | 2.2 | 5.4 | 3.9 |
| CV (%) | 11.9 | 34.1 | 29.5 | 8.7 | 9.1 | 7.1 | 5.55 | 3.98 | 6.30 |

**Soil moisture data in Sorghum under nutrient x moisture interaction in rainfed Alfisols – F1 2015**

Date of sowing: 16-6-2015 (one replication)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **2/7/2015** | | **10/7/2015** | | **21/7/2015** | | **30/7/2015** | | **4/8/2015** | |
|  | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** |
| 1 | 5.78 | 7.07 | 3.08 | 6.81 | 4.89 | 7.28 | 3.28 | 5.35 | 3.32 | 6.35 |
| 2 | 5.17 | 5.78 | 3.60 | 8.11 | 4.52 | 6.45 | 3.35 | 6.24 | 3.42 | 4.29 |
| 3 | 5.55 | 6.97 | 4.04 | 8.12 | 5.38 | 5.83 | 4.91 | 6.42 | 3.67 | 7.30 |
| 4 | 6.16 | 5.95 | 3.35 | 8.94 | 14.92 | 7.00 | 4.01 | 6.20 | 3.49 | 7.50 |
| 5 | 5.38 | 9.07 | 3.60 | 8.25 | 6.32 | 6.28 | 4.72 | 5.39 | 4.35 | 5.45 |
| 6 | 4.64 | 7.49 | 2.87 | 5.17 | 2.68 | 5.80 | 4.13 | 5.19 | 3.86 | 6.82 |
| 7 | 6.69 | 9.79 | 4.13 | 7.58 | 6.51 | 6.67 | 5.74 | 6.86 | 3.69 | 6.96 |
| 8 | 6.40 | 8.45 | 5.14 | 8.02 | 4.45 | 7.22 | 4.34 | 6.48 | 3.99 | 6.34 |
| 9 | 4.74 | 8.64 | 5.66 | 6.45 | 5.46 | 6.45 | 5.01 | 5.35 | 5.03 | 6.24 |
| Mean | 5.61 | 7.69 | 3.94 | 7.49 | 6.13 | 6.55 | 4.39 | 5.94 | 3.87 | 6.36 |

**F2: Performance of CASTOR in Sorghum – castor cropping system: Castor *kharif* 2015**

**Rainfed Alfisols**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Seed yield (kg/ha)** | **Stem Dry weight (kg/ha)** | **Total biological yield (kg/ha)** | **Harvest Index (%)** | **100 seed weight (g)** | **Days to 50% flowering** |
| 1 | 1619 | 1134 | 2753 | 59.6 | 23.0 | 53.3 |
| 2 | 1694 | 1389 | 3083 | 55.1 | 22.7 | 53.7 |
| 3 | 1715 | 1521 | 3237 | 53.5 | 23.8 | 53.3 |
| 4 | 1505 | 1263 | 2768 | 55.0 | 23.7 | 51.7 |
| 5 | 2266 | 1744 | 4010 | 57.4 | 24.2 | 51.0 |
| 6 | 1777 | 1242 | 3019 | 59.8 | 23.6 | 52.0 |
| 7 | 1629 | 1237 | 2866 | 56.8 | 23.2 | 52.3 |
| 8 | 1864 | 1533 | 3397 | 54.9 | 24.7 | 50.7 |
| 9 | 1383 | 834 | 2218 | 63.3 | 21.2 | 64.7 |
| Gen Mean | 1717 | 1322 | 3039 | 57.3 | 23.3 | 53.6 |
| SEm± | 74.0 | 207.0 | 248.3 | 34 | 0.3 | 1.0 |
| CD (P=0.05) | 222 | NS | 744 | NS | 0.9 | 3.0 |
| CV (%) | 7.5 | 27.1 | 14.1 | 10.28 | 2.50 | 3.22 |

**Soil moisture (%) data in Castor under nutrient x moisture interaction in rainfed Alfisols - F2 2015**

Date of sowing: 12-6-2015 (one replication data)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **2/7/2015** | | **19/7/2015** | | **21/7/2015** | | **30/7/2015** | | **4/8/2015** | |
| **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** | **0-15cm** | **15-30cm** |
| 1 | 4.66 | 6.57 | 4.97 | 7.83 | 4 | 5.91 | 5.2 | 10.06 | 3.56 | 5.87 |
| 2 | 3.75 | 3.73 | 3.57 | 4.79 | 3.38 | 6.98 | 3.64 | 4.87 | 4.46 | 5.05 |
| 3 | 4.28 | 6.67 | 4.11 | 4.7 | 3.35 | 4.4 | 6.54 | 7.74 | 4.18 | 4.76 |
| 4 | 4.22 | 6.6 | 3.12 | 5.06 | 2.79 | 3.44 | 6.02 | 4.86 | 3.81 | 4.57 |
| 5 | 5.26 | 7.13 | 4.79 | 8.79 | 3.8 | 3.72 | 6.32 | 7.89 | 4.12 | 6.81 |
| 6 | 4.14 | 5.06 | 3.45 | 6.63 | 5.23 | 5.19 | 3.16 | 4.83 | 3.61 | 4.85 |
| 7 | 4.54 | 5.82 | 3.54 | 5.63 | 3.43 | 7.65 | 4.17 | 8.24 | 4.01 | 6.29 |
| 8 | 4.42 | 5.1 | 3.72 | 7.66 | 5.81 | 8.46 | 8.2 | 7.85 | 4.62 | 7.28 |
| 9 | 5.06 | 6.63 | 3.8 | 8.06 | 6.25 | 7.2 | 6.29 | 5.68 | 4.8 | 7.5 |
| Mean | 4.48 | 5.92 | 3.90 | 6.57 | 4.23 | 5.88 | 5.50 | 6.89 | 4.13 | 5.89 |