**Appendix-I**

**Crop management practices for cotton**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No of farmer** | **Area (ha)** | **Cultivar** | **Tillage** | **Sowing date** | **Seed rate (kg/ha)** | **Spacing**  **(cm x cm)** | **Sowing method** | **Fertilizers**  **(kg/ha)** | **Time of fertilizer application** |
| 1 | 1.7 | Sarpas 7007 | MBP,TH,P,C,P | 16-05-13 | 2.4 | 60 x 45 | Hand plough | 80 kg DAP  185 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 2 | 2.5 | Sarpas 7007 | MBP,TH,P,C,P | 15-05-13 | 2.7 | 60 x 45 | Hand plough | 80 kg DAP  200 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 4 | 3.5 | Raghav 855 | MBP,TH,P,C,P | 21-05-13 | 2.4 | 60 x 45 | Hand plough | 75 kg DAP  200 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 8 | 8.7 | Raghav 855 | MBP,TH,P,C,P | 23-05-13 | 2.6 | 60 x 45 | Hand plough | 80 kg DAP  200 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 10 | 2.5 | Sarpas 7007 | MBP,TH,P,C,P | 18-05-13 | 2.4 | 60 x 45 | Hand plough | 90 kg DAP  185 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 12 | 1.5 | Sarpas 7007 | MBP,TH,P,C,P | 17-05-13 | 2.4 | 60 x 45 | Hand plough | 75 kg DAP  175 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 13 | 6.2 | Raghav 855 | MBP,TH,P,C,P | 22-05-13 | 2.5 | 60 x 45 | Hand plough | 80 kg DAP  200 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 18 | 4.0 | Raghav 855 | MBP,TH,P,C,P | 23-05-13 | 2.4 | 60 x 45 | Hand plough | 100 kg DAP  175 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |

**Appendix-II**

**Crop management practices for clusterbean**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No of farmer** | **Area (ha)** | **Cultivar** | **Tillage** | **Sowing date** | **Seed rate (kg/ha)** | **Spacing**  **(cm x cm)** | **Sowing method** | **Fertilizers**  **(kg/ha)** | **Time of fertilizer application** |
| 1 | 2.1 | RGC 1002 | MBP,TH,P,C,P | 14-05-13 | 18 | 30 x 10 | Seed drill | 80 kg DAP | Full N &  P as basal |
| 3 | 2.0 | HG 365 | MBP,TH,P,C,P | 17-05-13 | 15 | 30 x 10 | Seed drill | 60 kg DAP | Full N &  P as basal |
| 4 | 2.5 | RGC 1002 | MBP,TH,P,C,P | 16-05-13 | 15 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 5 | 6.2 | RGC 1002 | MBP,TH,P,C,P | 17-05-13 | 15 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 6 | 1.2 | HG 365 | MBP,TH,P,C,P | 18-05-13 | 16 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 7 | 2.0 | RGC 1002 | MBP,TH,P,C,P | 15-05-13 | 16 | 30 x 10 | Seed drill | 75 kg DAP | Full N &  P as basal |
| 8 | 3.7 | RGC 1017 | MBP,TH,P,C,P | 21-05-13 | 18 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 9 | 4.7 | RGC 1017 | MBP,TH,P,C,P | 22-05-13 | 16 | 30 x 10 | Seed drill | 75 kg DAP | Full N &  P as basal |
| 10 | 2.0 | RGC 1017 | MBP,TH,P,C,P | 21-05-13 | 18 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 18 | 1.0 | RGC 1002 | MBP,TH,P,C,P | 14-05-13 | 16 | 30 x 10 | Seed drill | 55 kg DAP | Full N &  P as basal |
| 19 | 1.0 | RGC 1017 | MBP,TH,P,C,P | 23-05-13 | 15 | 30 x 10 | Seed drill | 65 kg DAP | Full N &  P as basal |
| 20 | 4.4 | RGC 1002 | MBP,TH,P,C,P | 17-05-13 | 15 | 30 x 10 | Seed drill | 65 kg DAP | Full N & P as basal |

**Appendix-III**

**Crop management practices for wheat**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No of farmer** | **Area (ha)** | **Cultivar** | **Tillage** | **Sowing date** | **Seed rate (kg/ha)** | **Spacing**  **(cm x cm)** | **Sowing method** | **Fertilizers**  **(kg/ha)** | **Time of fertilizer application** |
| 1 | 1.7 | Raj-3077 | MBP,TH,P,C,P | 18-12-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 2 | 2 | HD-2329 | MBP,TH,P,C,P | 16-11-13 | 100-120 | 20 x 5 | Seed drill | 330 kg DAP  130 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 3 | 1.5 | Raj-3077 | MBP,TH,P,C,P | 17-11-13 | 120 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 4 | 3.5 | Raj-4037 | MBP,TH,P,C,P | 16-11-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 5 | 5 | PBW-343 | MBP,TH,P,C,P | 15-11-13 | 80-100 | 20 x 5 | Seed drill | 300 kg DAP  120 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 8 | 8 | Raj-4037 | MBP,TH,P,C,P | 16-11-13 | 110 | 20 x 5 | Seed drill | 300 kg DAP  120 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 10 | 6 | Raj-3077 | MBP,TH,P,C,P | 13-12-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 12 | 1 | HD-2329 | MBP,TH,P,C,P | 15-12-13 | 115-120 | 20 x 5 | Seed drill | 330 kg DAP  130 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 13 | 6.2 | PBW-343 | MBP,TH,P,C,P | 13-12-13 | 110 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 18 | 4 | Raj-4037 | MBP,TH,P,C,P | 3-12-13 | 115-120 | 20 x 5 | Seed drill | 300 kg DAP  120 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 19 | 6.2 | PBW-343 | MBP,TH,P,C,P | 24-11-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 20 | 3 | HD-2329 | MBP,TH,P,C,P | 21-11-13 | 100 | 20 x 5 | Seed drill | 300 kg DAP  120 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |

**Appendix-IV**

**Crop management practices for mustard**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No of farmer** | **Area (ha)** | **Cultivar** | **Tillage** | **Sowing date** | **Seed rate (kg/ha)** | **Spacing**  **(cm x cm)** | **Sowing method** | **Fertilizers**  **(kg/ha)** | **Time of fertilizer application** |
| 2 | 0.5 | salony | MBP,TH,P,C,P | 05-11-13 | 5-6 | 30 x 10 | Seed drill | 110 kg DAP  50 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 3 | 0.5 | Pusa bold | MBP,TH,P,C,P | 24-10-13 | 4-5 | 30 x 10 | Seed drill | 160 kg DAP  50 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 5 | 1.2 | Laxmi | MBP,TH,P,C,P | 26-10-13 | 5 | 30 x 10 | Seed drill | 160 kg DAP  70 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 6 | 1.2 | Laxmi | MBP,TH,P,C,P | 15-11-13 | 5 | 30 x 10 | Seed drill | 140 kg DAP  55 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 7 | 2 | Pusa bold | MBP,TH,P,C,P | 16-11-13 | 4-5 | 30 x 10 | Seed drill | 110 kg DAP  50 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 8 | 3.7 | Pusa bold | MBP,TH,P,C,P | 20-10-13 | 5 | 30 x 10 | Seed drill | 160 kg DAP  50 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 18 | 1 | salony | MBP,TH,P,C,P | 05-11-13 | 4-5 | 30 x 10 | Seed drill | 140 kg DAP  55 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |

**Appendix-V**

**Crop management practices for barley**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No of farmer** | **Area (ha)** | **Cultivar** | **Tillage** | **Sowing date** | **Seed rate (kg/ha)** | **Spacing**  **(cm x cm)** | **Sowing method** | **Fertilizers**  **(kg/ha)** | **Time of fertilizer application** |
| 1 | 2.1 | RD-2035 | MBP,TH,P,C,P | 16-12-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 4 | 2.5 | RD-2035 | MBP,TH,P,C,P | 12-12-13 | 100 | 20 x 5 | Seed drill | 275 kg DAP  110 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 9 | 5 | RD-2052 | MBP,TH,P,C,P | 13-12-13 | 100 | 20 x 5 | Seed drill | 250 kg DAP  100 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |
| 12 | 0.5 | RD-2052 | MBP,TH,P,C,P | 15-12-13 | 100 | 20 x 5 | Seed drill | 250 kg DAP  100 kg Urea | ½ N & Full P as basal  ½ N at 30 DAS |

**Appendix-Vl**

**Summary of CropSyst model settings for cotton varieties grown in Hanumangarh; C= calibrated; D= default; O= observed; L = literature**

| **Parameters** | **Cultivar** | | | |
| --- | --- | --- | --- | --- |
| **Sarpas 7007Bt** | | **Raghav-855** | |
| **Value** | **Source** | **Value** | **Source** |
| **Thermal time accumulation** |  |  |  |  |
| Base temperature (°C) | 21 | O | 21 | O |
| Cutoff temperature (°C) | 45 | O | 45 | O |
| **Phenology** |  |  |  |  |
| Accumulated growing degree days from seeding to |  |  |  |  |
| emergence (°C day) | 80 | O | 80 | O |
| maximum rooting depth (°C day) | 280 | O | 280 | C |
| end of vegetative growth | 620 | С | 310 | C |
| begin flowering (°C day) | 420 | O | 395 | O |
| begin filling (°C day) | 625 | O | 595 | O |
| physiological maturity (°C day) | 920 | O | 870 | O |
| Adjustment factor for phenologic response to stress (0-1) | 0.50 | C | 0.70 | D |
| **Senescence** |  |  |  |  |
| Leaf area duration (°C day) | 600 | C | 950 | C |
| Leaf area duration sensitivity to water stress(0-3) | 2 | C | 1 | D |
| **Canopy growth** |  |  |  |  |
| Initial green leaf area index (m2 m-2) | 0.011 | D | 0.011 | D |
| Min. Green LAI for regrowth (m2 m-2) | 0.011 | D | 0.011 | D |
| Maximum expected LAI (m2 m-2) | 3.0 | L | 5 | C |
| Specific leaf area, SLA (m2 kg-1) | 13 | O | 16 | C |
| Fraction of max. LAI at physiological maturity (0-1) | 0.55 | L | 0.55 | D |
| Leaf/stem partition coefficient, SLP | 3.0 | L | 3.0 | C |
| Leaf water potential that begins reduction of canopy expansion (J kg-1) | -800 | D | -800 | D |
| Leaf water potential that stops canopy expansion (J kg-1) | -1200 | D | -1200 | D |
| **Transpiration** |  |  |  |  |
| Canopy extinction coefficient (0-1) | 0.47 | L | 0.70 | D |
| Evapotranspiration crop coefficient at fully canopy | 1.28 | C | 1.25 | D |
| Maximum water uptake (mm d-1) | 14 | D | 14 | D |
| Leaf water potential at the onset of stomatal closure (J kg-1) | -1000 | C | -1000 | D |
| Wilting leaf water potential (J kg-1) | -1600 | C | -1600 | D |
| **Parameters** | **Cultivar** | | | |
| **Sarpas 7007Bt** | | **Raghav-855** | |
| **Value** | **Source** | **Value** | **Source** |
| **Attainable growth**  PAR use efficiency (g MJ-1) | 2.5 | С | 3.0 | C/D |
| Mean daily temperature that limits early growth (°C) | 25 | С | 25 | D |
| Transpiration use efficiency when VPD is at 1 k Pa (g BM/kg H20) | 5 | D | 5.5 | C/D |
| Scaling coefficient of TUE regression (power function) | 0.45 | D | 0.45 | C/D |
| **Harvest** |  |  |  |  |
| Unstressed harvest index (HI) | 0.26 | С | 0.28 | O |
| Sensitivity to water and N stress during flowering (0.5-1.5) | 1.5 | C | 0.50 | C |
| Sensitivity to temperature stress during flowering (0.5-1.5) | 1.5 | C | 0.50 | C |
| Biomass translocation to grain fraction (max) | 0.24 | C | 0.26 |  |
| **Root** |  |  |  |  |
| Maximum rooting depth (m) | 1.4 | D | 1.4 | C |
| Root length per unit root mass (km kg-1) | 100 | D | 100 | D |
| Max. surface root density at full rooting depth (cm cm-3) | 2 | С | 2.0 | D |
| Curvature of root density distribution (0.0001-6) | 0.100 | С | 0.100 | C |
| **Nitrogen** |  |  |  |  |
| Nitrogen demand adjustment (0-1) | 0.45 | C | 0.50 | C |
| Biomass to start dilution of maximum N concentration | 3.0 | D | 1.50 | D |
| Concentration curve slope (positive value) | 0.45 | D | 0.45 | D |
| Maximum above ground concentration at maturity | 0.011 | D | 0.011 | D |
| Max N concentration of chaff and stubble (kg kg-1 DM) | 0.002 | D | 0.005 | D |
| Standard root N concentration (kg kg-1 DM) | 0.002 | D | 0.002 | D |
| Maximum N uptake during rapid linear growth (kg ha-1 d-1) | 3 | С | 3 | D |
| Residual soil N not available for uptake (mg kg-1) | 1 | D | 1 | C |
| Soil N at which uptake starts decreasing (mg kg-1) | 5 | D | 5 | C |
| Plant avail. water at which N uptake start decreasing (0-1) | 0.5 | D | 0.5 | D |

**Appendix-VII**

**Summary of CropSyst model settings for clusterbean varieties grown in Hanumangarh; C = calibrated; D = default; O = observed; L = literature**

| **Parameters** | | **Cultivar** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RGC- 1002** | | **HG 365** | | | **RGC-1017** | |
| **Value** | **Source** | **Value** | **Source** | | **Value** | **Source** |
| **Thermal time accumulation** | |  |  |  |  | |  |  |
| Base temperature (°C) | | 12 | O | 12 | O | | 12 | O |
| Cutoff temperature (°C) | | 30 | O | 30 | O | | 30 | O |
| **Phenology** | |  |  |  |  | |  |  |
| Accumulated growing degree days from seeding to | |  |  |  |  | |  |  |
| emergence (°C day) | | 135 | O | 155 | O | | 155 | O |
| maximum rooting depth (°C day) | | 165 | O | 175 | C | | 175 | C |
| end of vegetative growth | | 170 | С | 185 | C | | 185 | C |
| begin flowering (°C day) | | 165 | O | 185 | O | | 190 | O |
| begin filling (°C day) | | 200 | O | 215 | O | | 215 | O |
| physiological maturity (°C day) | | 500 | O | 500 | O | | 500 | O |
| Adjustment factor for phenologic response to stress (0-1) | | 0.80 | C | 1.0 | D | | 1.0 | D |
| **Senescence** | |  |  |  |  | |  |  |
| Leaf area duration (°C day) | | 700 | C | 750 | C | | 750 | C |
| Leaf area duration sensitivity to water stress(0-3) | | 1.30 | C | 1.5 | D | | 1.50 | D |
| **Canopy growth** | |  |  |  |  | |  |  |
| Initial green leaf area index (m2 m-2) | | 0.011 | D | 0.011 | D | | 0.011 | D |
| Min. Green LAI for regrowth (m2 m-2) | | 0.011 | D | 0.011 | D | | 0.011 | D |
| Maximum expected LAI (m2 m-2) | | 4.0 | L | 4.0 | C | | 4.0 | C |
| Specific leaf area, SLA (m2 kg-1) | | 25 | O | 25 | C | | 25 | C |
| Fraction of max. LAI at physiological maturity (0-1) | | 0.50 | L | 0.50 | D | | 0.50 | D |
| Leaf/stem partition coefficient, SLP | | 1.0 | L | 1.20 | C | | 1.20 | C |
| Leaf water potential that begins reduction of canopy expansion (J kg-1) | | -800 | D | -800 | D | | -800 | D |
| Leaf water potential that stops canopy expansion (J kg-1) | | -1200 | D | -1200 | D | | -1200 | D |
| **Transpiration** | |  |  |  |  | |  |  |
| Canopy extinction coefficient (0-1) | | 0.55 | L | 0.70 | D | | 0.57 | D |
| Evapotranspiration crop coefficient at fully canopy | | 1.35 | C | 1.35 | D | | 1.35 | D |
| Maximum water uptake (mm d-1) | | 16 | D | 14 | D | | 14 | D |
| Leaf water potential at the onset of stomatal closure (J kg-1) | | -800.0 | C | -800 | D | | -800 | D |
| Wilting leaf water potential (J kg-1) | | -1400.0 | C | -1400 | D | | -1400 | D |
| **Attainable growth** |
| PAR use efficiency (g MJ-1) | | 3.0 | С | 3.0 | C/D | 3.0 | | C/D |
| Mean daily temperature that limits early growth (°C) | | 30 | С | 30 | D | 30 | | D |
| Transpiration use efficiency when VPD is at 1 k Pa (g BM/kg H20) | | 5 | D | 5.0 | C/D | 5 | | C/D |
| Scaling coefficient of TUE regression (power function) | | 0.45 | D | 0.45 | C/D | 0.45 | | C/D |
| **Harvest** | |  |  |  |  |  | |  |
| Unstressed harvest index (HI) | | 0.28 | С | 0.28 | O | 0.28 | | O |
| Sensitivity to water and N stress during flowering (0.5-1.5) | | 0.50 | C | 0.30 | C | 0.30 | | C |
| Sensitivity to temperature stress during flowering (0.5-1.5) | | 0.50 | C | 0.30 | C | 0.30 | | C |
| Biomass translocation to grain fraction (max) | | 0.27 | C | 0.27 |  | 0.27 | |  |
| **Root** | |  |  |  |  |  | |  |
| Maximum rooting depth (m) | | 1.5 | D | 1.5 | C | 1.5 | | C |
| Root length per unit root mass (km kg-1) | | 90 | D | 90 | D | 90 | | D |
| Max. surface root density at full rooting depth (cm cm-3) | | 3 | С | 3 | D | 3 | | D |
| Curvature of root density distribution (0.0001-6) | | 1.8 | С | 2.0 | C | 2.0 | | C |
| **Nitrogen** | |  |  |  |  |  | |  |
| Nitrogen demand adjustment (0-1) | | 0.50 | C | 0.45 | C | 0.40 | | C |
| Biomass to start dilution of maximum N concentration | | 2.0 | D | 2.3 | D | 2.3 | | D |
| Concentration curve slope (positive value) | | 0.45 | D | 0.45 | D | 0.45 | | D |
| Maximum above ground concentration at maturity | | 0.015 | D | 0.018 | D | 0.018 | | D |
| Max N concentration of chaff and stubble (kg kg-1 DM) | | 0.010 | D | 0.003 | D | 0.003 | | C |
| Standard root N concentration (kg kg-1 DM) | | 0.010 | D | 0.003 | D | 0.003 | | C |
| Maximum N uptake during rapid linear growth (kg ha-1 d-1) | | 4.0 | С | 4.0 | D | 4.0 | | D |
| Residual soil N not available for uptake (mg kg-1) | | 3.0 | D | 3.0 | C | 3.0 | | C |
| Soil N at which uptake starts decreasing (mg kg-1) | | 5 | D | 5 | C | 5 | | D |
| Plant avail. water at which N uptake start decreasing (0-1) | | 0.5 | D | 0.5 | D | 0.5 | | D |

**Appendix-VIII**

**Summary of CropSyst model settings for wheat varieties grown in Hanumangarh; C = calibrated; D = default; O = observed; L = literature**

| **Parameters** |  | |  | | **Cultivar** | |  | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Raj 3077** | | **HD 2329** | | **Raj 4037** | | **PBW 343** | |
| Value | Source | Value | Source | Value | Source | Value | Source |
| **Thermal time accumulation** |  |  |  |  |  |  |  |  |
| Base temperature (°C) | 4 | O | 4 | O | 4 | O | 4 | O |
| Cutoff temperature (°C) | 30 | O | 30 | O | 30 | O | 30 | O |
| **Phenology** |  |  |  |  |  |  |  |  |
| Accumulated growing degree days from seeding to |  |  |  |  |  |  |  |  |
| emergence (°C day) | 105 | O | 110 | O | 100 | O | 110 | O |
| maximum rooting depth (°C day) | 180 | O | 218 | C | 190 | C | 192 | C |
| end of vegetative growth | 300 | С | 275 | C | 320 | C | 300 | C |
| begin flowering (°C day) | 320 | O | 310 | O | 280 | O | 270 | O |
| begin filling (°C day) | 450 | O | 430 | O | 385 | O | 350 | O |
| physiological maturity (°C day) | 900 | O | 675 | O | 700 | O | 815 | O |
| Adjustment factor for phenologic response to stress (0-1) | 0.5 | C | 0.5 | D | 0.5 | D | 0.5 | D |
| **Senescence** |  |  |  |  |  |  |  |  |
| Leaf area duration (°C day) | 550 | C | 700 | C | 550 | C | 670 | C |
| Leaf area duration sensitivity to water stress(0-3) | 2.0 | C | 2 | D | 0.50 | D | 0.50 | D |
| **Canopy growth** |  |  |  |  |  |  |  |  |
| Initial green leaf area index (m2 m-2) | 0.011 | D | 0.011 | D | 0.011 | D | 0.020 | D |
| Min. Green LAI for regrowth (m2 m-2) | 0.011 | D | 0.011 | D | 0.011 | D | 0.020 | D |
| Maximum expected LAI (m2 m-2) | 5.0 | L | 5.0 | C | 5.0 | C | 8 | C |
| Specific leaf area, SLA (m2 kg-1) | 22 | O | 22 | C | 22 | C | 22 | C |
| Fraction of max. LAI at physiological maturity (0-1) | 0.90 | L | 0.80 | D | 0.90 | D | 0.9 | D |
| Leaf/stem partition coefficient, SLP | 1.8 | L | 1.8 | C | 1.7 | C | 1.8 | C |
| Leaf water potential that begins reduction of canopy expansion (J kg-1) | -800 | D | -800 | D | -800 | D | -800 | D |
| Leaf water potential that stops canopy expansion (J kg-1) | -1200 | D | -1200 | D | -1200 | D | -1200 | D |
| **Transpiration** |  |  |  |  |  |  |  |  |
| Canopy extinction coefficient (0-1) | 0.60 | L | 0.65 | D | 0.5 | D | 0.57 | D |
| Evapotranspiration crop coefficient at fully canopy | 1.3 | C | 1.3 | D | 1.31 | D | 1.15 | D |
| Maximum water uptake (mm d-1) | 10 | D | 10 | D | 10 | D | 10 | D |
| Leaf water potential at the onset of stomatal closure (Jkg-1) | -1500 | C | -1500 | D | -1500 | D | -1500 | D |
| Wilting leaf water potential (J kg-1) | -2500 | C | -2500 | D | -2500 | D | -2500 | D |
| **Attainable growth** |  |  |  |  |  |  |  |  |
| PAR use efficiency (g MJ-1) | 5 | С | 5 | C/D | 7 | C/D | 5 | C/D |
| Mean daily temperature that limits early growth (°C) | 8 | С | 8 | D | 6 | D | 8 | D |
| Transpiration use efficiency when VPD is at 1 k Pa (g BM/kg H20) | 5.7 | D | 5.5 | C/D | 5.9 | C/D | 5.45 | C/D |
| Scaling coefficient of TUE regression (power function) | 0.46 | D | 0.45 | C/D | 0.5 | C/D | 0.45 | C/D |
| **Harvest** |  |  |  |  |  |  |  |  |
| Unstressed harvest index (HI) | 0.43 | С | 0.42 | O | 0.42 | O | 0.42 | O |
| Sensitivity to water and N stress during flowering (0.5-1.5) | 0.5 | C | 1.5 | C | 0.5 | C | 1.0 | C |
| Sensitivity to temperature stress during flowering (0.5-1.5) | 0.5 | C | 1.5 | C | 0.5 | C | 1.0 | C |
| Biomass translocation to grain fraction (max) | 0.42 | C | 0.41 |  | 0.40 |  | 0.40 |  |
| **Root** |  |  |  |  |  |  |  |  |
| Maximum rooting depth (m) | 1.5 | D | 1.5 | C | 1.50 | C | 1.3 | C |
| Root length per unit root mass (km kg-1) | 120 | D | 120 | D | 120 | D | 110 | D |
| Max. surface root density at full rooting depth (cm cm-3) | 3 | С | 4 | D | 3 | D | 4 | D |
| Curvature of root density distribution (0.0001-6) | 1 | С | 1 | C | 0.06 | C | 0.10 | C |
| **Nitrogen** |  |  |  |  |  |  |  |  |
| Nitrogen demand adjustment (0-1) | 0.70 | C | 0.64 | C | 0.53 | C | 0.48 | C |
| Biomass to start dilution of maximum N concentration | 0.5 | D | 1.5 | D | 0.7 | D | 1 | D |
| Concentration curve slope (positive value) | 0.5 | D | 0.45 | D | 0.550 | D | 0.45 | D |
| Maximum above ground concentration at maturity | 0.016 | D | 0.016 | D | 0.016 | D | 0.016 | D |
| Max N concentration of chaff and stubble (kg kg-1 DM) | 0.006 | D | 0.002 | D | 0.006 | C | 0.006 | C |
| Standard root N concentration (kg kg-1 DM) | 0.006 | D | 0.002 | D | 0.006 | C | 0.002 | C |
| Maximum N uptake during rapid linear growth (kg ha-1 d-1) | 8 | С | 5 | 5 | 4.50 | D | 5 | D |
| Residual soil N not available for uptake (mg kg-1) | 1 | D | 1 | C | 3 | C | 3 | C |
| Soil N at which uptake starts decreasing (mg kg-1) | 10 | D | 7 | C | 10 | D | 10 | D |
| Plant avail. water at which N uptake start decreasing (0-1) | 0.90 | D | 0.50 | D | 0.80 | D | 0.8 | D |

**Appendix-IX**

**Summary of CropSyst model settings for mustard varieties grown in Hanumangarh; C = calibrated; D = default; O = observed; L = literature**

| **Parameters** | | | | | **Cultivar** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Laxmi** | | **Pusa bold** | | | **Salony** | |
| **Value** | **Source** | **Value** | **Source** | | **Value** | **Source** |
| **Thermal time accumulation** | | | | |  |  |  |  | |  |  |
| Base temperature (°C) | | | | | 05 | O | 05 | O | | 03 | O |
| Cutoff temperature (°C) | | | | | 30 | O | 30 | O | | 35 | O |
| **Phenology** | | | | |  |  |  |  | |  |  |
| Accumulated growing degree days from seeding to | | | | |  |  |  |  | |  |  |
| emergence (°C day) | | | | | 100 | O | 100 | O | | 90 | O |
| maximum rooting depth (°C day) | | | | | 220 | O | 220 | C | | 120 | C |
| end of vegetative growth | | | | | 250 | С | 255 | C | | 550 | C |
| begin flowering (°C day) | | | | | 230 | O | 230 | O | | 250 | O |
| begin filling (°C day) | | | | | 275 | O | 275 | O | | 310 | O |
| physiological maturity (°C day) | | | | | 720 | O | 650 | O | | 760 | O |
| Adjustment factor for phenologic response to stress (0-1) | | | | | 1.0 | C | 0.8 | D | | 1.0 | D |
| **Senescence** | | | | |  |  |  |  | |  |  |
| Leaf area duration (°C day) | | | | | 700 | C | 450 | C | | 400 | C |
| Leaf area duration sensitivity to water stress(0-3) | | | | | 2 | C | 2 | D | | 2 | D |
| **Canopy growth** | | | | |  |  |  |  | |  |  |
| Initial green leaf area index (m2 m-2) | | | | | 0.011 | D | 0.011 | D | | 0.011 | D |
| Min. Green LAI for regrowth (m2 m-2) | | | | | 0.011 | D | 0.011 | D | | 0.011 | D |
| Maximum expected LAI (m2 m-2) | | | | | 6.0 | L | 6.0 | C | | 6 | C |
| Specific leaf area, SLA (m2 kg-1) | | | | | 25 | O | 23 | C | | 22 | C |
| Fraction of max. LAI at physiological maturity (0-1) | | | | | 0.80 | L | 0.80 | D | | 0.80 | D |
| Leaf/stem partition coefficient, SLP | | | | | 2.4 | L | 2.8 | C | | 2.8 | C |
| Leaf water potential that begins reduction of canopy expansion (J kg-1) | | | | | -800 | D | -800 | D | | -800 | D |
| Leaf water potential that stops canopy expansion (J kg-1) | | | | | -1200 | D | -1200 | D | | -1200 | D |
| **Transpiration** | | | | |  |  |  |  | |  |  |
| Canopy extinction coefficient (0-1) | | | | | 0.50 | L | 0.60 | D | | 0.60 | D |
| Evapotranspiration crop coefficient at fully canopy | | | | | 1.20 | C | 1.35 | D | | 1.2 | D |
| Maximum water uptake (mm d-1) | | | | | 10 | D | 10 | D | | 7 | D |
| Leaf water potential at the onset of stomatal closure (J kg-1) | | | | | -700 | C | -700 | D | | -700 | D |
| Wilting leaf water potential (J kg-1) | | | | | -1600 | C | -1600 | D | | -1600 | D |
| **Attainable growth** |  |  |  |
| PAR use efficiency (g MJ-1) | | | | | 3.0 | С | 3.0 | C/D | 3.0 | | C/D |
| Mean daily temperature that limits early growth (°C) | | | | | 10 | С | 10 | D | 10 | | D |
| Transpiration use efficiency when VPD is at 1 k Pa (g BM/kg H20) | | | | | 5 | D | 5.1 | C/D | 4.5 | | C/D |
| Scaling coefficient of TUE regression (power function) | | | | | 0.45 | D | 0.45 | C/D | 0.45 | | C/D |
| **Harvest** | | | | |  |  |  |  |  | |  |
| Unstressed harvest index (HI) | | | | | 0.33 | С | 0.32 | O | 0.33 | | O |
| Sensitivity to water and N stress during flowering (0.5-1.5) | | | | | 1.5 | C | 1.2 | C | 1.0 | | C |
| Sensitivity to temperature stress during flowering (0.5-1.5) | | | | | 1.5 | C | 1.2 | C | 1.0 | | C |
| Biomass translocation to grain fraction (max) | | | | | 0.31 | C | 0.31 |  | 0.30 | |  |
| **Root** | | | | |  |  |  |  |  | |  |
| Maximum rooting depth (m) | | | | | 1.4 | D | 1.3 | C | 1.4 | | C |
| Root length per unit root mass (km kg-1) | | | | | 90 | D | 90 | D | 90 | | D |
| Max. surface root density at full rooting depth (cm cm-3) | | | | | 3 | С | 3 | D | 3 | | D |
| Curvature of root density distribution (0.0001-6) | | | | | 0.100 | С | 0.100 | C | 0.100 | | C |
| **Nitrogen** | | | | |  |  |  |  |  | |  |
| Nitrogen demand adjustment (0-1) | | | | | 0.50 | C | 0.50 | C | 0.40 | | C |
| Biomass to start dilution of maximum N concentration | | | | | 1.5 | D | 1.50 | D | 1.7 | | D |
| Concentration curve slope (positive value) | | | | | 0.45 | D | 0.45 | D | 0.45 | | D |
| Maximum above ground concentration at maturity | | | | | 0.023 | D | 0.010 | D | 0.023 | | D |
| Max N concentration of chaff and stubble (kg kg-1 DM) | | | | | 0.002 | D | 0.002 | D | 0.002 | | C |
| Standard root N concentration (kg kg-1 DM) | | | | | 0.002 | D | 0.002 | D | 0.002 | | C |
| Maximum N uptake during rapid linear growth (kg ha-1 d-1) | | | | | 3 | С | 2 | D | 2 | | D |
| Residual soil N not available for uptake (ppm) | | | | | 1 | D | 1 | C | 1 | | C |
| Soil N at which uptake starts decreasing (ppm) | | | | | 5 | D | 10 | C | 5 | | D |
| Plant avail. water at which N uptake start decreasing (0-1) | | | | | 0.5 | D | 0.5 | D | 0.7 | | D |

**Appendix-X**

**Summary of CropSyst model settings for barley varieties grown in Hanumangarh; C = calibrated; D = default; O = observed; L = literature**

| **Parameters** | **Barley, RD 2035** | | **Barley, RD 2052** | |
| --- | --- | --- | --- | --- |
| **Value** | **Source** | **Value** | **Source** |
| **Thermal time accumulation** |  |  |  |  |
| Base temperature (°C) | 4 | O | 4 | O |
| Cut off temperature (°C) | 30 | O | 30 | O |
| **Phenology** |  |  |  |  |
| Accumulated growing degree days from seeding to |  |  |  |  |
| emergence (°C day) | 105 | O | 105 | O |
| maximum rooting depth (°C day) | 221 | O | 221 | O |
| end of vegetative growth | 310 | С | 310 | С |
| begin flowering (°C day) | 300 | O | 300 | O |
| begin filling (°C day) | 425 | O | 425 | O |
| physiological maturity (°C day) | 1100 | O | 1100 | O |
| Adjustment factor for phenologic response to stress (0-1) | 1.0 | C | 1.0 | C |
| **Senescence** |  |  |  |  |
| Leaf area duration (°C day) | 1000 | C | 800 | C |
| Leaf area duration sensitivity to water stress(0-3) | 3.00 | C | 2 | C |
| **Canopy growth** |  |  |  |  |
| Initial green leaf area index (m2 m-2) | 0.011 | D | 0.011 | D |
| Min. Green LAI for regrowth (m2 m-2) | 0.011 | D | 0.011 | D |
| Maximum expected LAI (m2 m-2) | 5.0 | L | 5.0 | L |
| Specific leaf area, SLA (m2 kg-1) | 24 | O | 20 | O |
| Fraction of max. LAI at physiological maturity (0-1) | 0.8 | L | 0.8 | L |
| Leaf/stem partition coefficient, SLP | 2.5 | L | 2.7 | L |
| Leaf water potential that begins reduction of canopy expansion (J kg-1) | -800 | D | -800 | D |
| Leaf water potential that stops canopy expansion (J kg-1) | -1200 | D | -1200 | D |
| **Transpiration** |  |  |  |  |
| Canopy extinction coefficient (0-1) | 0.80 | L | 0.50 | L |
| Evapotranspiration crop coefficient at fully canopy | 1.23 | C | 1.28 | C |
| Maximum water uptake (mm d-1) | 10 | D | 10 | D |
| Leaf water potential at the onset of stomatal closure (J kg-1) | -700 | C | -700 | C |
| Wilting leaf water potential (J kg-1) | -1600 | C | -1600 | C |
| **Attainable growth** |  |  |  |  |
| PAR use efficiency (g MJ-1) | 3 | С | 3 | С |
| Mean daily temperature that limits early growth (°C) | 10 | С | 10 | С |
| Transpiration use efficiency when VPD is at 1 k Pa (g BM/kg H20) | 4.5 | D | 4.5 | D |
| Scaling coefficient of TUE regression (power function) | 0.45 | D | 0.45 | D |
| **Harvest** |  |  |  |  |
| Unstressed harvest index (HI) | 0.43 | С | 0.42 | С |
| Sensitivity to water and N stress during flowering (0.5-1.5) | 1.20 | C | 1.20 | C |
| Sensitivity to temperature stress during flowering (0.5-1.5) | 1.20 | C | 1.20 | C |
| Biomass translocation to grain fraction (max) | 0.42 | C | 0.41 | C |
| **Root** |  |  |  |  |
| Maximum rooting depth (m) | 1.4 | D | 1.4 | D |
| Root length per unit root mass (km kg-1) | 100 | D | 100 | D |
| Max. surface root density at full rooting depth (cm cm-3) | 3 | С | 3 | С |
| Curvature of root density distribution (0.0001-6) | 0.100 | С | 0.100 | С |
| **Nitrogen** |  |  |  |  |
| Nitrogen demand adjustment (0-1) | 0.30 | C | 0.45 | C |
| Biomass to start dilution of maximum N concentration | 1.2 | D | 1.2 | D |
| Concentration curve slope (positive value) | 0.45 | D | 0.45 | D |
| Maximum above ground concentration at maturity | 0.010 | D | 0.010 | D |
| Max N concentration of chaff and stubble (kg kg-1 DM) | 0.003 | D | 0.003 | D |
| Standard root N concentration (kg kg-1 DM) | 0.003 | D | 0.003 | D |
| Maximum N uptake during rapid linear growth (kg ha-1 d-1) | 4 | С | 2.5 | С |
| Residual soil N not available for uptake (mg kg-1) | 1 | D | 1 | D |
| Soil N at which uptake starts decreasing (mg kg-1) | 5 | D | 5 | D |
| Plant avail. water at which N uptake start decreasing (0-1) | 0.8 | D | 0.5 | D |

**Appendix-XI**

**Comparative economics and cost of cultivation of cotton grown at Menawali, Hanumangarh**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Farmer No.** | **Land preparation** | **Sowing** | **Seedcost (120px-Indian_Rupee_symbol/ha)** | **Intercultural operation** | **Fertilizer** | **Irrigation** | **Plant protection** | **Piking** | **Harvesting** | **GR**  **(120px-Indian_Rupee_symbol/ha)** | **CC**  **(120px-Indian_Rupee_symbol/ha)** | **NR**  **(120px-Indian_Rupee_symbol/ha)** |
| 1 | 5600 | 1050 | 4536 | 3469 | 4300 | 3000 | 5180 | 7700 | 4675 | 128693 | 39510 | 89183 |
| 2 | 5700 | 1075 | 5103 | 3650 | 4380 | 2160 | 5225 | 7425 | 5040 | 135966 | 39758 | 96208 |
| 4 | 5600 | 1080 | 4440 | 3845 | 4275 | 2000 | 5165 | 8100 | 4250 | 122776 | 38755 | 84021 |
| 8 | 5750 | 1050 | 4810 | 3925 | 4115 | 2200 | 5120 | 8120 | 4760 | 133022 | 39850 | 93172 |
| 10 | 5700 | 1100 | 4536 | 3650 | 4530 | 3000 | 5550 | 7840 | 5400 | 137511 | 41306 | 96205 |
| 12 | 5600 | 1050 | 4536 | 4620 | 4135 | 2400 | 5575 | 8400 | 5700 | 133984 | 42016 | 91968 |
| 13 | 5400 | 1080 | 4625 | 5740 | 4390 | 2240 | 4040 | 7280 | 5040 | 133245 | 39835 | 93410 |
| 18 | 5800 | 1075 | 4440 | 5400 | 4630 | 2400 | 5150 | 7280 | 5600 | 124274 | 41775 | 82499 |
| 19 | 5550 | 1100 | 4625 | 6400 | 4045 | 2080 | 5110 | 7840 | 4760 | 128653 | 41510 | 87143 |
| **Mean** | **5633** | **1073** | **4628** | **4522** | **4311** | **2387** | **5124** | **7776** | **5025** | **130903** | **40479** | **90423** |
| **SD** | **120** | **20** | **211** | **1074** | **194** | **371** | **444** | **394** | **473** | **5108** | **1174** | **5023** |

**Appendix-XII**

**Comparative economics and cost of cultivation of clusterbean grown at Menawali, Hanumangarh**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Farmer No.** | **Land preparation** | **Sowing** | **Seedcost (120px-Indian_Rupee_symbol/ha)** | **Intercultural operation** | **Fertilizer** | **Irrigation** | **Plant protection** | **Harvesting** | **Threshing** | **GR**  **(120px-Indian_Rupee_symbol/ha)** | **CC**  **(120px-Indian_Rupee_symbol/ha)** | **NR**  **(120px-Indian_Rupee_symbol/ha)** |
| 1 | 5200 | 1075 | 1170 | 3140 | 2640 | 600 | 1250 | 6000 | 2860 | 88266 | 23935 | 64331 |
| 3 | 5600 | 1075 | 945 | 3700 | 2180 | 560 | 1250 | 5320 | 2820 | 81286 | 23450 | 57836 |
| 4 | 5400 | 1080 | 1050 | 3400 | 2295 | 520 | 1260 | 5130 | 3420 | 89520 | 23555 | 65965 |
| 5 | 5400 | 1050 | 1020 | 3080 | 2295 | 600 | 1260 | 5700 | 2860 | 91120 | 23265 | 67855 |
| 6 | 5500 | 1050 | 1120 | 3450 | 2295 | 500 | 1910 | 4800 | 3300 | 76761 | 23925 | 52836 |
| 7 | 5500 | 1050 | 1040 | 3175 | 2525 | 500 | 1910 | 4500 | 3300 | 89502 | 23500 | 66002 |
| 8 | 5550 | 1050 | 1170 | 3475 | 2295 | 500 | 1910 | 5400 | 3450 | 87571 | 24800 | 62771 |
| 9 | 5550 | 1075 | 1040 | 3425 | 2525 | 500 | 1935 | 4675 | 3225 | 89067 | 23950 | 65117 |
| 10 | 5600 | 1100 | 1080 | 2875 | 2295 | 500 | 1910 | 4680 | 3180 | 85993 | 23220 | 62773 |
| 18 | 5500 | 1050 | 1120 | 3700 | 2065 | 500 | 1910 | 4320 | 3480 | 86213 | 23645 | 62568 |
| 19 | 5550 | 1050 | 1080 | 3470 | 2295 | 540 | 1930 | 4950 | 3300 | 88677 | 24165 | 64512 |
| 20 | 5500 | 1050 | 1050 | 3750 | 2295 | 550 | 1900 | 4860 | 3520 | 93334 | 24475 | 68859 |
| **Mean** | **5488** | **1063** | **1074** | **3387** | **2333** | **531** | **1695** | **5028** | **3226** | **87276** | **23824** | **63452** |
| **SD** | **111** | **17** | **64** | **271** | **158** | **39** | **325** | **499** | **250** | **4441** | **482** | **4391** |

**Appendix-XIII**

**Comparative economics and cost of cultivation of wheat grown at Menawali, Hanumangarh**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Farmer No.** | **Land preparation** | **Sowing** | **Seedcost (120px-Indian_Rupee_symbol/ha)** | **Intercultural operation** | **Fertilizer** | **Irrigation** | **Plant protection** | **Harvesting** | **Threshing** | **GR**  **(120px-Indian_Rupee_symbol/ha)** | **CC**  **(120px-Indian_Rupee_symbol/ha)** | **NR**  **(120px-Indian_Rupee_symbol/ha)** |
| 1 | 5200 | 1050 | 2000 | 3200 | 8035 | 3000 | 1340 | 3500 | 2750 | 90300 | 30075 | 60225 |
| 2 | 3600 | 1060 | 2420 | 3450 | 9420 | 3000 | 2665 | 3920 | 3100 | 84784 | 32635 | 52149 |
| 3 | 5550 | 1050 | 2400 | 2900 | 8035 | 3500 | 1340 | 4125 | 2825 | 89224 | 31725 | 57499 |
| 4 | 5400 | 1075 | 1900 | 3425 | 8285 | 2880 | 1350 | 4000 | 2750 | 82744 | 31065 | 51679 |
| 5 | 3500 | 1050 | 2000 | 3150 | 8920 | 3500 | 1340 | 4400 | 3100 | 86256 | 30960 | 55296 |
| 8 | 5600 | 1050 | 2090 | 2875 | 8920 | 3000 | 1360 | 4675 | 3025 | 85817 | 32595 | 53222 |
| 10 | 5700 | 1075 | 2200 | 3150 | 8035 | 3000 | 1345 | 4250 | 2750 | 86275 | 31505 | 54770 |
| 12 | 5750 | 1050 | 2185 | 2900 | 9670 | 3120 | 1390 | 4400 | 3300 | 92957 | 33765 | 59192 |
| 13 | 5550 | 1050 | 2200 | 3180 | 8920 | 3240 | 1440 | 3570 | 2795 | 87102 | 31945 | 55157 |
| 18 | 5350 | 1075 | 2280 | 3150 | 8920 | 3780 | 2140 | 4480 | 2840 | 84723 | 34015 | 50708 |
| 19 | 5800 | 1050 | 2000 | 3170 | 8285 | 3000 | 2590 | 4410 | 2870 | 97400 | 33175 | 64225 |
| 20 | 5600 | 1050 | 1900 | 2910 | 8920 | 2400 | 1310 | 4125 | 2825 | 90737 | 31040 | 59697 |
| **Mean** | **5217** | **1057** | **2131** | **3122** | **8697** | **3118** | **1634** | **4155** | **2911** | **88193** | **32042** | **56152** |
| **SD** | **797** | **11** | **178** | **195** | **554** | **355** | **516** | **360** | **178** | **4124** | **1214** | **4082** |

**Appendix-XIV**

**Comparative economics and cost of cultivation of mustard grown at Menawali, Hanumangarh**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Farmer No.** | **Land preparation** | **Sowing** | **Seedcost (120px-Indian_Rupee_symbol/ha)** | **Intercultural operation** | **Fertilizer** | **Irrigation** | **Plant protection** | **Harvesting** | **Threshing** | **GR**  **(120px-Indian_Rupee_symbol/ha)** | **CC**  **(120px-Indian_Rupee_symbol/ha)** | **NR**  **(120px-Indian_Rupee_symbol/ha)** |
| 2 | 5500 | 950 | 1450 | 3150 | 3880 | 1560 | 500 | 4125 | 2700 | 68983 | 23815 | 45168 |
| 3 | 5350 | 1050 | 1200 | 2900 | 5030 | 1500 | 1620 | 4000 | 2750 | 61856 | 25400 | 36456 |
| 5 | 5600 | 1075 | 1350 | 3650 | 5150 | 1620 | 1030 | 4400 | 3025 | 73073 | 26900 | 46173 |
| 6 | 4900 | 1050 | 1400 | 3400 | 4600 | 1500 | 1045 | 4125 | 2625 | 71030 | 24545 | 46485 |
| 7 | 5700 | 1050 | 1450 | 2650 | 3880 | 1620 | 1010 | 4125 | 2610 | 68321 | 24095 | 44226 |
| 8 | 5600 | 1100 | 1500 | 2900 | 5030 | 1500 | 1050 | 4050 | 2700 | 64992 | 25430 | 39562 |
| 18 | 5700 | 1050 | 1160 | 3150 | 4600 | 1800 | 1010 | 3850 | 2625 | 60770 | 24945 | 35825 |
| **Mean** | **5479** | **1046** | **1359** | **3114** | **4596** | **1586** | **1038** | **4096** | **2719** | **67004** | **25019** | **41985** |
| **SD** | **283** | **47** | **131** | **336** | **534** | **109** | **324** | **167** | **144** | **4621** | **1032** | **4607** |

**Appendix-XV**

**Comparative economics and cost of cultivation of barley grown at Menawali, Hanumangarh**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Farmer No.** | **Land preparation** | **Sowing** | **Seedcost (120px-Indian_Rupee_symbol/ha)** | **Intercultural operation** | **Fertilizer** | **Irrigation** | **Plant protection** | **Harvesting** | **Threshing** | **GR**  **(120px-Indian_Rupee_symbol/ha)** | **CC**  **(120px-Indian_Rupee_symbol/ha)** | **NR**  **(120px-Indian_Rupee_symbol/ha)** |
| 1 | 5400 | 1050 | 1500 | 2900 | 8035 | 2000 | 1400 | 3750 | 2750 | 63021 | 28785 | 34236 |
| 4 | 5600 | 1075 | 1400 | 2650 | 8285 | 2080 | 1415 | 4000 | 2825 | 63133 | 29330 | 33803 |
| 9 | 4800 | 1050 | 1500 | 3150 | 7650 | 2000 | 1430 | 3500 | 2780 | 60669 | 27860 | 32809 |
| 12 | 5500 | 1060 | 1400 | 2930 | 7650 | 2080 | 1440 | 3250 | 2810 | 62843 | 28120 | 34723 |
| **Mean** | **5325** | **1059** | **1450** | **2908** | **7905** | **2040** | **1421** | **3625** | **2791** | **62417** | **28524** | **33893** |
| **SD** | **359** | **12** | **58** | **205** | **312** | **46** | **18** | **323** | **33** | **1171** | **664** | **814** |