# Package of Practices for Organic Production of Crops and Cropping Systems

## ICAR-Network Project Organic Farming

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# UTTARAKHAND

## Suggested cropping systems (based on testing under NPOF)

1. Basmati rice-wheat-*Sesbania*
2. Basmati rice-Lentil-*Sesbania*
3. Basmati rice-Vegetable pea-*Sesbania*
4. Basmati rice-*Brassica napus*-*Sesbania*
5. Basmati rice-Chickpea-*Sesbania* (Under biodynamic practices)

## Details of crops in cropping systems

### Basmati rice *(Kharif)*

| Particulars | *Kharif* |
|---|---|
| Crop | Basmati rice |
| Fortnight of sowing/planting | Ist fortnight of June (sowing)<br>IInd fortnight of June (Transplanting) |
| Fortnight of harvesting | IInd fortnight of October (Harvesting) |
| Varieties suitable for organic farming | Pusa Basmati-1 |

### Important features of suitable varieties

| Parameters | Pusa Basmati-1 |
|---|---|
| Duration (days) | Medium (130-135days) |
| Average yield under organic condition (kg/ha) | 3500 kg/ha |
| Source (s) of availability | In-situ organic field |
| Suitable regions/districts in the state | Udham Singh Nagar |
| Specific resistance / tolerance to disease | Blast |

## Nursery raising practices

| | | | |
|---|---|---|---|
| Area of nursery required for 1 ha | 1000 $m^2$ | | |
| Nursery raising method | Wet nursery | | |
| Bed size (length X breadth in m) | 5m x 2m | | |
| Seed sowing rate/$m^2$ | 30 g | | |
| Pre-sowing seed/soil treatment | Materials | Quantity/kg of seed or per $m^2$area | Method of application |
| | Common salt | 1.65 kg salt/10 l of fresh water | Dipping the seeds |
| | Pant Bioagent-3 (mixture of *Pseudomonas* &*Trichoderma)* | 10g/kg seed | Seed treatment |
| Source and optimum quantity of organic manures/other nutrient source/$m^2$ of nursery | Materials | Quantity/ $m^2$area | Method of application |
| | *Sesbania* green manuring | 1.0-1.5 kg | Incorporation in soil |
| | FYM | 2.5 kg/$m^2$ | broadcast |
| | Leacheate of vermicompost + $ZnSO_4$ | 10% + 0.5 % | sprays at 10 & 20 days after sowing |
| Irrigation practices | 3 irrigations | | |
| Weed management | 1 HW at 15 DAS | | |
| Organic plant protection practices | Name of pest/ disease | Recommended organic material used for control | Quantity/ $m^2$area |
| | Stem borer | Cow urine (10 %) + Neem cake (10 %) or neem oil (1-2%) | |
| | - | Precautionary spray of *Trichoderma* + *Pseudomonas* (each @ 5g/l) after 15 days or Pant Bioagent-3 @ 10 g/l of water | |
| Optimum age of nursery (days) | 20-25 days | | |

**Field preparation:**For transplanted rice, in-situ *Sesbania* green manure grown and incorporated with the help of mould board plough followed by two round of puddling by puddler.Soil application of PSF &*Trichoderma* each @ 5g/l or Pant Bioagent-3 @ 10 g/l of water (5.0 kg Pant Bio-agent-3 with 500 l water/ha) after incorporation of green manure at the time of soil preparation.

## Cultural practices

| | | | |
|---|---|---|---|
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (*Pseudomonas*+ *Trichoderma)* | 250 g/l water | Seedling treatment through root dipping |
| Spacing (Row X plant) in cm | 20 x10cm | | |
| Number of seedlings/hill (in nursery crops only) | 2 | | |
| Basal application of organic manures including soil application of bio-fertilizers, bio-control agents etc | Source<br>Green manure | Quantity/ha<br>15-20 t/ha green biomass | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | V.C. (if FYM has not been applied) | 2.5 t/ha | 20 DAT |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10 % with 500 litre water /ha) | 3-4 sprays at 15 days interval start from 20-25 days after transplanting |
| | Or Cow urine + neem oil | 10% + 1% | |
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | Depth of irrigation (cm) |
| | 6-8 | Transplanting, tillering, PI, flowering & grain filling | 5.0-7.0 cm |
| Major weeds | Scientific Name | English Name | Local Name |
| | *Echinochloa colonum* | Wild rice | Chotta sawan |

| | | | |
|---|---|---|---|
| | *Echinochloa crusgalli* | Banyard grass | Sawan |
| | *Leptochloa chinensis* | | *American ghas* |
| | *Cyperus rotundus* | Purple nut sedge | Motha |
| | *Cyperus iria* | Yellow sedge | Motha |
| | *Cyperus difformis* | Common sedge | Motha |
| | Ec*lipta alba* | false daisy | Jal bhangra |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 20 & 40 DAT | One mechanical weeding by conoweeder at 15 DAT followed by one or two hand weeding 25 & 45 DAT | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Yellow stem borer, Leaf folder, Brown plant hopper | Pheromone traps<br>Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) or Cow urine + neem oil (10 % +1%) | 20 traps/ha<br>50 l/ha (10 % with 500 litre water / ha).50 litre cow urine + 5 litre neem oil/ha. |
| | Bacterial leaf blight<br>Sheath blight<br>Sheath rot<br>Brown leaf spot | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) + *Trichoderma* + *Pseudomonas* (each @ 5g/l) after or Pant Bioagent-3 @ 10 g/l of water | 50 litre cow urine+ 5 kg Pant Bio-agent 3 in 500 litre of water /ha |

## Yield

| Parameters | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic yield (kg/ha) | 2266 | 2344 | 2456 | 2963 | 3445 | 2885 | 3113 | 3715 | 3925 | 3012 |

## Wheat (*Rabi*)

Important features of suitable varieties

| Parameters | PBW-343 |
|---|---|
| Duration (days) | Medium (135-150days) |
| Average yield under organic condition (kg/ha) | 2911 kg/ha |
| Source (s) of availability | In-situ |
| Suitable regions/districts in the state | Indo Gangetic Plain (U.S.Nagar) |
| Specific resistance / tolerance to disease | Resistant to brown and yellow rust, tolerant to Karnal Bunt |

**Field preparation:** After harvest of rice, one ploughing followed by two harrowing was done.

### Cultural practices

| | | | |
|---|---|---|---|
| Seed rate (kg/ha) (Not applicable for nursery crops) | 100 kg/ha | | |
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10g/kg seed | Seed treatment |
| Spacing (Row X plant) in cm | 22 cm | | |
| Basal application of organic | Source | Quantity/ha | |
| manures including soil | FYM | 10 t/ha | |
| application of bio-fertilizers, | Vermicompost | 5 t/ha | |
| bio-control agents etc | | | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10% with 500 litre water /ha) | Two sprays at 30 and 60 days after sowing |

| | | | |
|---|---|---|---|
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | Depth of irrigation (cm) |
| | 3-4 | Crown root initiation, tillering, flowering and grain-filling stage | 5-6 cm |
| Major weeds | Scientific Name | English Name | Local Name |
| | *Phalaris minor* | Bird's seed grass | Gehun ka mama |
| | *Chenopodium album* | Goose foot | Bathua |
| | *Lathyirus aphaca* | *Crow pea* | *Chatri-matri* |
| | *Melilotus alba* | *White sweet clover* | *Sufaid Senji* |
| | *Melilotusindica* | *Yellowsweetclover* | *Zard Senji* |
| | *Fumaria perviflora* | *Fumitory* | *Jungli gazar* |
| | *Anagallis arvensis* | *Blue pimpernel* | *Krishna -neel* |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 30 & 45 DAS | Stale bed + one hand weeding or two hand weeding | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Wheat aphid | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) or Cow urine + neem oil (10 % +1%) | 50 l/ha (10 % with 500 litre water /ha) or 50 litre cow urine + 5 litre neem oil/ha |
| | Brown rust, Yellow rust, Powdery mildew | Cow urine + Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10% cow urine + 10 g/l of water (50 litre cow urine + 5 kg Pant Bio-agent 3 in 500 litre water/ha) |

## Yield

| **Parameters** | **2004-05** | **2005-06** | **2006-07** | **2007-08** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic yield (kg/ha) | 1383 | 1735 | 2662 | 2359 | 2493 | 3645 | 3677 | 4103 | 4142 | 2911 |

### *Sesbania* (*Summer*)

**Important features of suitable varieties**

| Parameters | (Pant Ses-1) |
|---|---|
| Duration (days) | 50-55 days |
| Average yield under organic condition (kg/ha) | 16000 kg/ha(green biomass); 3450 kg/ha (dry matter) |
| Source (s) of availability | Seed Production Centre, Pantnagar |
| Suitable regions/districts in the state | U.S.Nagar |

**Field preparation:** After harvest of *Rabi* crops, field was harrowed and seeds of *Sesbania* were sown @ 30 kg/ha. It should be ensured that moisture availability should be there otherwise, irrigation should be given immediate after sowing of *Sesbania* seed.

### Cropping System 2: Basmati rice-Lentil-*Sesbania*

| Particulars | *Kharif* | *Rabi* | Summer |
|---|---|---|---|
| Crop | Basmati rice | Lentil | *Sesbania* |
| Fortnight of sowing/planting | Ist fortnight (FN) of June (sowing) IInd fortnight of June (Transplanting) | IInd FN of November (sowing) | Ist FN of May |
| Fortnight of harvesting | IInd fortnight of October (Harvesting) | Ist FN of April (Harvesting) | IInd FN of June (Harvesting) |
| Varieties suitable for organic farming | Pusa basmati-1 | Pant Lentil-6 | Pant Ses-1 |

### Lentil (*Rabi*)

Important features of suitable varieties

| Variety | Pant Lentil-6 |
|---|---|
| Duration (days) | Medium (120-135) |
| Average yield under organic condition (kg/ha) | 851 kg/ha |
| Source (s) of availability | In-situ |
| Suitable regions/districts in the state | U.S.Nagar |
| Specific resistance / tolerance to pest | Tolerant to pod borer |
| Specific resistance / tolerance to disease | Resistant to rust, wilt and Aschochyta blight |

**Field preparation:** After harvest of rice, one ploughing followed by two harrowing was done.

## Cultural practices

| | | | |
|---|---|---|---|
| Seed rate (kg/ha) | 30 kg/ha | | |
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10g/kg seed | Seed treatment |
| Spacing (Row X plant) in cm | 30 x 10cm | | |
| Basal application of organic manures including soil application of bio-fertilizers, bio-control agents etc | Source | Quantity/ha | |
| | FYM | 5t/ha | |
| | Vermicompost | 2.5t/ha | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10% with 500 litre water /ha) | Two sprays at 30 and 60 days after sowing |
| Major weeds | Scientific Name | English Name | Local |
| | *Phalaris minor* mama | Bird's seed grass | Gehun ka |
| | *Chenopodium album Lathyirus aphacamatri* | Goose foot *Crow pea* | Bathua *Chatri-Sufaid* |
| | *Melilotus alba Senji* | *White sweet clover* | *Zard* |
| | *Melilotusindica Senji Fumaria* | *Yellow sweet clover* *Fumitory* | *Jungli* |
| | *pervifloragazar Anagallis arvensis neel* | *Blue pimpernel* | *Krishna* |

| | | | |
|---|---|---|---|
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 25 & 45 DAS | Stale bed + hand weeding or one mechanical + one hand weeding | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Wilt<br>Rust | Cow urine + Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10% cow urine + 10 g/l of water (50 litre cow urine + 5 kg Pant Bio-agent 3 in 500 litre water/ ha); 5-6 sprays are required in 15 days intervals |

## Yield

| Parameters | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Economic yield (kg/ha) | 354 | 445 | 774 | 731 | 972 | 601 | 1234 | 1702 | 852 |

# Glimpses

Incorporation of *Sesbania* Green manure


Sesbania green manure (var. Pant Ses-1)

## Vegetable pea (*Rabi*)

### Important features of suitable varieties

| Parameters | Arkel |
|---|---|
| Duration (days) | Early (90-120d) |
| Average yield under organic condition (kg/ha) | 4331 kg/ha |
| Source (s) of availability | In-situ |
| Suitable regions/districts in the state | U.S.Nagar |
| Specific resistance / tolerance to disease | Susceptible to powdery mildew |

**Field preparation:** After harvest of rice, one ploughing followed by two harrowing were done.

### Cultural practices

| | | | |
|---|---|---|---|
| Seed rate (kg/ha) | 80 | | |
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (Pseudomonas + Trichoderma ) | 10g/kg seed | Seed treatment |
| Spacing (Row X plant) in cm | 30 x 10cm | | |
| Basal application of organic | Source | Quantity/ha | |
| manures including soil | FYM | 5.0 t/ha | |
| application of bio-fertilizers, | Vermicompost | 2.5 t/ha | |
| bio-control agents etc | | | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10 % with 500 litre water /ha) | 3-4 sprays at 15 days interval start from 20-25 days after transplanting |

| | | | |
|---|---|---|---|
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | Depth of irrigation (cm) |
| | 1 | Pre-flowering | 2-3 cm |
| Major weeds | Scientific Name | English Name | Local Name |
| | *Phalaris minor* | Bird's seed grass | Gehun ka mama |
| | *Chenopodium album* | Goose foot | Bathua |
| | *Chenopodium murale* | *Fat hen* | *Karund* |
| | *Melilotus alba* | *White sweet clover* | *Sufaid Senji* |
| | *Melilotusindica* | *Yellow sweet clover* | *Zard Senji* |
| | *Fumaria perviflora* | *Fumitory* | *Jungli gazar* |
| | *Cynodon dactylon* | | *doob-ghas* |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 25 & 45 DAS | Stale bed preparation + 1 Hand weeding or one mechanical + 1 HW at 25 & 45 DAS | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Rust, Powdery Mildew, Blight | *Pseudomonas florescence & Trichoderma spp.* | Each @ 5g/L at the time of soil preparation, before and after flowering to control disease. |
| | Pea leaf minor, Pod borer | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) or Cow urine + neem oil (10 % +1%) | 50 l/ha (10 % with 500 litre water / ha).50 litre cow urine + 5 litre neem oil/ha. |
| Optimum stage of harvesting (in case of vegetables and green cob) | 90-100 days | | |

## Yield

| Parameters | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic yield (kg/ha) | 3408 | 3198 | 2573 | 2479 | 3393 | 3941 | 5534 | 6272 | 6320 | 3686 |

## Glimpses


Treatment of lentil with Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma*)

Vegetable pea under organic mode

## Crop *(Rabi)*: *Brassica napus*

### Important features of suitable varieties

| Variety | GLS-1 |
|---|---|
| Duration (days) | Medium (135-150days) |
| Average yield under organic condition (kg/ha) | 956 kg/ha |
| Source (s) of availability | In-situ |
| Suitable regions/districts in the state | U.S.Nagar |

**Field preparation:** After harvest of rice, **o**ne ploughing followed by two harrowing were done.

### Cultural practices

| | | | |
|---|---|---|---|
| Seed rate (kg/ha) | 2-3 kg/ha | | |
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (Pseudomonas + Trichoderma ) | 10g/kg seed | Seed treatment |
| Spacing (Row X plant) in cm | 30X20 | | |
| Basal application of organic | Source | Quantity/ha | |
| manures including soil | FYM | 10.0 t/ha | |
| application of bio-fertilizers, | Vermicompost | 5.0 t/ha | |
| bio-control agents etc | | | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | V.C. | 5 t/ha | 20 DAS |
| | FYM | 10t/ha | Basal |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10 % with 500 litre water /ha) | 3-4 sprays at 15 days interval start from 20-25 days after transplanting |

| | | | |
|---|---|---|---|
| | Or Cow urine+ neem oil | 10% + 1% | |
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | Depth of irrigation (cm) |
| Major weeds | Scientific Name<br>Phalaris minor<br>Chenopodium album Lathyirus aphaca<br>Convolvulus arvensis<br>Melilotus alba<br>Melilotusindica<br>Fumaria perviflora<br>Anagallis arvensis<br>Cynodon dactylon | English Name<br>Bird's seed grass<br>Goose foot<br>Crow pea<br>Field binweedkhuri<br>White sweet clover<br>Yellow sweeclover<br>Fumitory<br>Blue pimpernel | Local Name<br>Gehun ka mama Bathua<br>Chatri-matri Hiran<br>Sufaid Senji Zard<br>Senji Jungli gazar<br>Krishna – neeldoob-ghas |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 20 & 40 DAS | Stale bed + 1Hand weeding or one mechanical weeding + 1 HW | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Root rot, White rust, Downey mildew | *Pseudomonas florescence & Trichoderma spp.* | each @ 5g/L at the time of soil preparation, before and after flowering to control disease. |
| | Mustard Aphid, Mustard Saw fly | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) or Cow urine + neem oil (10 % +1%) | 50 l/ha (10 % with 500 litre water / ha).50 litre cow urine + 5 litre neem oil/ha. |

## Yield

| Parameters | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic yield (kg/ha) | 342 | 300 | 603 | 785 | 840 | 915 | 1158 | 1777 | 1886 | 956 |

## Basmati rice (*Kharif*)

| Particulars | *Kharif* |
|---|---|
| Crop | Basmati rice |
| Fortnight of sowing/planting | Ist fortnight of June (sowing)<br>IInd fortnight of June (Transplanting) |
| Fortnight of harvesting | IInd fortnight of October (Harvesting) |
| Varieties suitable for organic farming | Pusa -1121 |

Important features of suitable varieties

| Parameters | Pusa 1121 |
|---|---|
| Duration (days) | Medium (135-140 days) |
| Average yield under organic condition (kg/ha) | 3958 kg/ha |
| Source (s) of availability | In-situ organic field |
| Suitable regions/districts in the state | Udham Singh Nagar |

## Nursery raising practices

| | | | |
|---|---|---|---|
| Area of nursery required for 1 ha | 1000 $m^2$ | | |
| Nursery raising method | Wet nursery | | |
| Bed size (length X breadth in m) | 5m x 2m | | |
| Seed sowing rate/$m^2$ | 30 g | | |
| Pre-sowing seed/soil treatment | Materials | Quantity/kg of seed or per $m^2$area | Method of application |
| | Common salt | 1.65 kg salt/10 l of fresh water | Dipping the seeds |
| | Pant Bioagent-3 (mixture of *Pseudomonas* & *Trichoderma)* | 10g/kg seed | Seed treatment |
| Source and optimum quantity of organic manures/other nutrient source/$m^2$ of nursery | Materials | Quantity/ $m^2$area | Method of application |
| | *Sesbania* green manuring | 1.0-1.5 kg | Incorporation in soil |
| | FYM | 2.5 kg/$m^2$ | broadcast |

| | | | |
|---|---|---|---|
| | Leachates of vermicompost + $ZnSO_4$ | 10% + 0.5 % | sprays at 10 & 20 days after sowing |
| Irrigation practices | 3 irrigations | | |
| Weed management | 1 HW at 15 DAS | | |
| Organic plant protection practices | Name of pest/ disease | Recommended organic material used for control | |
| | | *Leacheate* of Vermicompost + Cow urine (10 %) + Neem cake (10 %) or neem oil (1-2%) | |
| | | *Trichoderma* + *Pseudomonas* (each @ 5g/l) after 15 days or Pant Bioagent-3 @ 10 g/l of water | |
| Optimum age of nursery (days) | 20-25 days | | |

**Field preparation:** For transplanted rice, in-situ *Sesbania* green manure grown and incorporated with the help of mould board plough followed by two round of puddling by puddler. Soil application of PSF &*Trichoderma* each @ 5g/l or Pant Bioagent-3 @ 10 g/l of water (5.0 kg Pant Bio-agent-3 with 500 l water/ha) was done after incorporation of green manure at the time of soil preparation.

## Cultural practices

| | | | |
|---|---|---|---|
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (*Pseudomonas*+ *Trichoderma)* | 250 g/l water | Seedling treatment through root dipping |
| Spacing (Row X plant) in cm | 20 x 10cm | | |
| Number of seedlings/hill (in nursery crops only) | 2 | | |
| Basal application of organic manures including soil application of bio-fertilizers, bio-control agents etc | Source<br>Green manure<br>Soil application of BD-500FYME.C | Quantity/ha<br>16-20 t/ha<br>62.5g/ha5t/ha5t/ha | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | V.C. | 2.5 t/ha | 20 DAT |
| | N.C. | 0.5 t/ha | 20 DAT |

| | | | |
|---|---|---|---|
| | BD-501 | 2.5g/ha | Flowering & seed-setting stage(as per biodynamic calendar) |
| | CPP | 2.5kg/ha | Flowering & seed-setting stage |
| | Panchgavya | @0.3% (1.5 l Panchgavya in 500 l of water) | Flowering & 15 days after flowering |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10 % with 500 litre water /ha) | 3-4 sprays at 15 days interval start from 20-25 days after transplanting |
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | Depth of irrigation (cm) |
| | 6-8 | Transplanting, tillering, PI, flowering & grain filling | 5.0-7.0 cm |
| Major weeds (give local, english and scientific name) | Scientific Name | English Name | Local Name |
| | *Echinochloa colonum* | Wild rice | Chotta sawan |
| | *Echinochloa crusgalli* | Banyard grass | Sawan |
| | *Leptochloa chinensis* | Purple nut sedge | Motha |
| | *American ghas Cyperus rotundus Cyperus iria* | Yellow sedge | Motha |
| | *Cyperus difformis* | Common sedge | Motha |
| | Ec*lipta alba* | false daisy | Jal bhangra |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 20 & 40 DAT | One mechanical weeding by conoweeder 15 DAT followed by one or two hand weeding 25 & 45 DAT | |

| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
|---|---|---|---|
| | Yellow stem borer<br>Leaf folder | Pheromone traps | 20 traps/ha |
| | Brown plant hopper | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) or Cow urine + neem oil (10 % +1%) | 50 l/ha (10 % with 500 litre water / ha).50 litre cow urine + 5 litre neem oil/ha. |
| | Bacterial leaf blight<br>Sheath blight<br>Sheath rot<br>Brown leaf spot | Cow urine fortified with Neem leaves (one kg green leaves/ 10.0 l of urine) + *Trichoderma* + *Pseudomonas* (each @ 5g/l) after or Pant Bioagent-3 @ 10 g/l of water | 50 litre cow urine+ 5kg Pant Bio-agent 3 in 500 litre of water /ha |

## Yield

| Parameters | 2009 | 2010 | 2011 | 2012 | Mean |
|---|---|---|---|---|---|
| Economic yield (kg/ha) | 3598 | 3144 | 4555 | 4535 | 3958 |

## Chickpea (*Rabi*)

### Important features of suitable varieties

| Variety | Pant Kabuli Chana-1 |
|---|---|
| Duration (days) | Medium (120-135) |
| Average yield under organic condition (kg/ha) | 1809 kg/ha |
| Source (s) of availability | In-situ |
| Suitable regions/districts in the state | U.S.Nagar |
| Specific resistance / tolerance to disease | Resistant to botrytis grey mould |

**Field preparation:** After harvest of rice, one ploughing followed by two harrowing was done.

### Cultural practices

| | | | |
|---|---|---|---|
| Seed rate (kg/ha) | 30 kg/ha | | |
| Pre-sowing/planting treatment of seed/seedlings | Material | Recommended rate (kg/ha or lit/ha) | Method of application |
| | Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10g/kg seed | Seed treatment |
| Spacing (Row X plant) in cm | 30 x 10cm | | |
| Basal application of organic manures including soil application of bio-fertilizers, bio-control agents etc | Source | Quantity/ha | |
| | Soil application of BD-500 | 62.5g/ha | |
| | FYM | 2.0 t/ha | |
| | E.C | 2.0 t/ha | |
| | V.C. | 1.0 t/ha | |
| | N.C. | 0.2t/ha | |
| Top dressing of organic manures | Source | Quantity/ha | Days after sowing/ planting or stage of crop |
| | BD-501 | 2.5g/ha | Flowering & fruit-setting stage(as per biodynamic calendar) |

| | | | |
|---|---|---|---|
| | CPP | 2.5kg/ha | Flowering & fruit-setting stage |
| | Panchgavya | @0.3% (1.5 l Panchgavya in 500 l of water) | Flowering & 15 days after flowering |
| | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | 50 l/ha (10 % with 500 litre water /ha) | Two sprays at 30 and 60 days after sowing |
| Irrigation practices | Number of irrigations | Most critical stages for irrigation | |
| | 1 | Flowering or pod formation | |
| Major weeds | Scientific Name | English Name | Local Name |
| | *Phalaris minor* | Bird's seed grass | Gehun ka mama |
| | *Chenopodium album* | Goose foot | Bathua |
| | *Chenopodium murale* | *Fat hen* | *Karund* |
| | *Melilotus alba* | *White sweet clover* | *Sufaid Senji* |
| | *Melilotusindica* | *Yellow sweet clover* | *Zard Senji* |
| | *Fumaria perviflora* | *Fumitory* | *Jungli gazar* |
| | *Vicia sativa* | *Common vetch* | *Choti phalli/ Akra* |
| | *Anagallis arvensis* | *Blue pimpernel* | *Krishna-neel* |
| Weed management | Critical stage of weeding | Recommended practice for organic condition | |
| | 20 & 40 DAS | Stale bed + hand weeding | |
| Organic plant protection practices | Name of pest/ disease | Organic material recommended for control | Quantity (kg or litres/ ha) |
| | Wilt, Blight | Cow urine + Pant Bioagent-3 (mixture of *Pseudomonas* + *Trichoderma* ) | 10% cow urine + 10 g/l of water (50 litre cow urine + 5 kg Pant Bio-agent 3 in 500 litre water/ ha); 5-6 sprays are required in 15 days intervals |

| | | | |
|---|---|---|---|
| | Pod borer | Cow urine fortified with Neem leaves (one kg green leaves/ 10 l of urine) | |
| | | HNPV | 1.5 l/ha |

## Yield

| Parameters | 2009-10 | 2010-11 | 2011-12 | 2012-13* | Mean |
|---|---|---|---|---|---|
| Economic yield (kg/ha) | 1458 | 1335 | 2003 | 2440 | 1809 |

## Details of Specific Practices/products used/recommended

(Please give details of *panchagavya*, cow urine, BD preparation and any other ITK products including its method of preparation etc)

**Neem fortified cow urine:** Cow urine was fortified with neem leaves @ 1kg fresh neem leaves in 10 l of cow urine kept for 10 to 15 days. Alternately, 1% neem oil can also be used for the fortification of cow urine at the time of spraying.

***Panchgavya*:** Panchgavya is basically the mixture of five main ingredients *viz.,* cow dung, cow ghee, cow urine, cow milk and cow curd. In addition to above five ingredients, tender coconut water, jaggery and well ripened banana can also be used for its preparation. For preparation of panchgavya, mix cow dung (7kg) and cow ghee (1kg) in a wide- mouthed plastic can and should be mixed in morning and evening hours and kept for 3 days. After 3 days, mix cow urine (10 l) and water (10 l) and keep it for 15 days with regular mixing both in morning and evening hours. After 15 days, mix cow milk (3 l), cow curd (2 l), tender coconut water (3 l), Jaggery (3 kg) and well ripened banana (12 nos.) and container should be kept open under shade and stock Panchgavya solution will be ready after 30 days.

**BD-500 (Cow horn Manure):** It is basically fermented cow dung which is buried in September-November and lifted in February-March. For the preparation of BD-500, cow horns and fresh cow dung from a lactating cow is needed (average 50-150g dung/horn). For this burial pits were prepared (18 inches deep) and the pit area should not be subject to flooding, vigorous root systems or earthworms. Filled cow horns with cow dung in October-November were placed in burial pits, 1 inches apart with base downwards, surrounded with 50% compost and soil and bury for 4 to 6 months keeping the burial pit soil moist and shaded at temperature approximately 20$^0$C and free from weeds and earthworms. After 4 months, check

for dung fermentation (if green cow dung has turned into dark, smooth earthy smelling humus) and lifted.

**BD-501(Cow horn Silica):** It is finely ground quartz crystals especially prepared. The crystals used should be of good quality, shape and clear. It is buried in the similar manner to preparation of BD-500 but this time buried during the summer time (April-May and lifted in September). For the preparation of BD-501, cow horns and silica quartz crystals are needed (average 200-300g powdered quartz crystals/horn). Silica quartz is crushed and grinded to make a fine powder between two plate glasses and moisten with water to make a stiff paste to fill the horns and buried in soil pit, 1 inch apart with base downwards surrounded with 50% compost and soil.

**Cow Pat Pit (CPP):** It is cow manure mixed with crushed egg shell and basalt dust, which is put into 12 inches deep pit lined with bricks. The dung is fermented, together with preparation 502-507 for a period of 3 to 4 months. When mature, it is mixed with water, @ 1 kg in 40 litres of water per acre (1 CPP pit is sufficient to cover 40 acres) and 60 kg of cow dung gives about 30-35 kg of CPP after fermentation. CPP is applied in the evening during the cooler months.