Storage

- Store the seeds with a seed moisture content of 10 - 12 % in gunny or cloth bags for short term storage (8 - 9 months).
- Store the seeds with a seed moisture content of 8 - 9 % in polylined gunny bag for medium term storage (12 - 15 months).
- Store the seeds with a seed moisture content less than 8 % in 700 gauge polythene bag for long term storage (more than15 months).

(iii) GREENGRAM (*Vigna radiata* L.)

Climate requirement

T_Max°C	T_Min°C	Optimum °C	Rainfall mm	Altitude m MSL
40	20	25 - 32	600 - 800	2000

Tropical and subtropical hot climate. The crop needs a well - distributed rainfall. Heavy rains at flowering are harmful, even moist winds at this stage interfere with fertilization. It can tolerate drought to a great extent. It is considered to be the hardiest pulse among all pulse crops. Day neutral plant.

CROP IMPROVEMENT

i. SEASON AND VARIETIES

District/season	Varieties
Adipattam (June - July) All districts except Kanyakumari and Nilgiris	CO(Gg) 7, VBN(Gg) 2, VBN(Gg) 3, CO 8, VBN 4
Puratasipattam (September - October) Kanchipuram, Thiruvallur, Dharmapuri, Vellore, Tiruvannamalai, Salem, Namakkal, Cuddalore, Villupuram, Thiruchirapalli, Perambalur, Erode, Coimbatore, Madurai, Dindigul, Theni, Pudukottai, Sivagangi, Ramanthapuram, Virudhunagar, Thoothukudi and Thirunelveli,	Co(Gg) 7, VBN(Gg) 2, VBN(Gg) 3, CO 8, VBN 4
Margazhi-Thai Pattam (December – January) All districts except Kanyakumari and Nilgiris	VBN(Gg)3, CO(Gg) 7, CO 8
Rice fallows (January - February) Thanjavur, Thiruvarur, Nagapattinam, Cuddalore,	ADT 3

Summer (February - March) Thanjavur, Thiruvarur, Nagapattinam, Cuddalore, Villupuram, Tiruchirapalli, Perambalur, Thiruvallur, Kanchipuram	VBN(Gg) 3, CO(Gg) 7, CO 8, VBN 4

II. DESCRIPTION OF GREENGRAM VARIETIES

Particulars	Co (Gg) 7	CO 8	VBN(Gg) 2	VBN (Gg) 3	ADT 3	VBN 4
Year of Release	2005	2013	2001	2009	1988	2019
Year of Notification	SO.1177 (E)/ 25.08.05	SO.268(E)/ 28.01.2015	SO.1197(E)/ 14.11.2002	SO.2137(E)/ 31.08.2010	SO.793(E)/ 22.11.1991	SO.3220(E) /05.09.2019
Parentage	MGG336 x CoGG 902	COGG 923 x VC 8040A	VGG 4 x MH 309	CO 1 x Vellore local	H7016 x Rajendran G65	PDM 139 x BB 2664
Maturity duration (days)	60-65	55- 60	65-70	65-75	70-75	65-70
Grain yield (kg/ha)						
Rainfed (kg/ha)	980	-	750	775	500 (rice fallow)	936
Irrigated (kg/ha)	-	845	900	880	-	1251
Height (cm)	30 - 45	55-65	50-60	35-55	40-60	45-55
Pod Colour at maturity	Brown	Brown	Black	Brown	Black	
100 grain wt (g)	3.5 – 4.0	3.5-4	3.6-3.9	2.8-3.5	2.5-3.5	35-40
Special features	High protein content (25.2%), High seed weight and synchronized maturity	Suitable for single/mechanical harvest. Moderately resistant to YMV and stem necrosis diseases. Moderately resistant to sucking pests like aphids and stem fly	Moderately resistant to Yellow Mosaic, Synchronize pod maturity	Moderately resistant to powdery mildew and Yellow mosaic Indeterminate flowering	Suitable only for Rice fallow and Margazhi pattam	Resident to urbean leaf crinkle virus, moderately resistant to yellow mosaic virus and powdery mildew diseases

I. SEED RATE

Particulars — Quantity of seed required kg/ha

	Pure crop	Mixed crop
All varieties	20	10
Rice fallows - ADT 3	30	--

II. MANAGEMENT OF FIELD OPERATIONS

1. FIELD PREPARATION

i. Prepare the land to get fine tilth and form beds and channels.

ii Amendments for soil surface crusting: To tide over the soil surface crusting apply lime at the rate of 2 t/ha along with FYM at 12.5 t/ha or composted coir pith at 12.5 t/ha to get an additional yield of about 15 - 20%.

2. SEED TREATMENT

Treat the seeds with Carbendazim or Thiram @ 2 g/kg of seed 24 hours before sowing (or) with talc formulation of *Trichoderma viride* @ 4g/kg of seed (or) *Pseudomonas fluorescens* @ 10 g/kg seed. Bio control agents are compatible with biofertilizers. First treat the seeds with Biocontrol agents and then with Rhizobium. Fungicides and biocontrol agents are incompatible.

3. SEED TREATMENT WITH BIOFERTILIZER

a) Treat the seeds required for sowing 1 ha with 200g each of Rhizobial culture COG 15, Phosphobacteria and PGPR (*Pseudomonas* sp.) using rice gruel, shade dry it before sowing. (or) Treat one hectare of seeds with 25 g each of powder formulation of *Rhizobium* and AM fungi using binder (polymer), shade dry before sowing.

b) If seed treatment is not carried out, apply 2 kg each Rhizobial culture, Phosphobacteria and PGPR (*Pseudomonas* sp.) with 25 kg of FYM and 25 kg of sand, mix uniformly before sowing.

4. FERTILIZER APPLICATION

If soil test is not done ,

Apply fertilizers basally before sowing.

Rainfed : 12.5 kg N + 25 kg P_2O_5 + 12.5 kg K_2O +20 kg S*/ha Irrigated : 25 kg N + 50 kg P_2O_5 + 25 kg K_2O + 40 kg S*/ha

*Note : Applied in the form of gypsum if Single Super Phospate is not applied as a source of phosphorus

Soil test crop response based integrated plant nutrition system (STCR- IPNS recommendation may be adopted for prescribing fertilizer doses for specified yield targets. (ready reckoners are furnished)

Soil : Red sandy loam (Irugur series)
Target: 0.8– 0.9 t ha^{-1}

FN = 25.07 T - 0.71 SN
FP_2O_5 = 15.44 T - 5.48 SP
FK_2O = 11.00 T - 0.19 SK

Initial soil test values (kg ha^{-1})			Yield target –0. 8 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + PSB @ 2 kg ha^{-1}			Yield target – 0.9 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + PSB @ 2 kg ha^{-1}		
SN	**SP**	**SK**	**FN**	**FP_2O_5**	**FK_2O**	**FN**	**FP_2O_5**	**FK_2O**
160	12	160	38**	26	18	38**	41	29
180	14	180	33	25*	14	38**	30	25
200	16	200	19	25*	13*	38**	25*	21
220	18	220	13*	25*	13*	29	25*	17
240	20	240	13*	25*	13*	15	25*	13

* Maintenance dose;** Maximum dose

Note: FN, FP_2O_5 and FK_2O are fertilizer N, P_2O_5 and K_2O in kg ha^{-1}, respectively; T is the yield target in q ha^{-1}; SN, SP and SK respectively are available N,P and K in kg ha^{-1} and ON, OP and OK are the quantities of N, P and K supplied through organic manure in kg ha^{1}.

c) Soil application of 25 kg $ZnSO_4$/ha or 12.5 kg $ZnSO_4$ as EFYM under irrigated condition

d) Soil application of TNAU micronutrient mixture @ 5 kg/ha as Enriched FYM (Prepare enriched FYM at 1:10 ratio of MN mixture & FYM ; mix at friable moisture &incubate for one month in shade).

50 kg $FeSO_4$ as EFYM or 10 by Fe EDTA ha^{-1} for the deficient soils.

Multi-blooming technology for irrigated green gram in new delta region of Thanjavur

For higher yield and income, apply 25:50:25:20 kg NPKS/ha.+25 kg N/ha. in 3 equal splits on 30, 45 and 60 days after sowing + 2% DAP spray on 45 and 60 days after sowing.

Foliar spraying of 0.5% $ZnSO_4$ thrice, 1% $FeSO_4$ + 0.1% Citric acid thrice can be followed when plants shows deficiency symptoms at 7-10 days intervals.

e) Foliar spray of 1% urea for yield improvement in green gram

For yield improvement through increasing the physiological, biochemical attributes, foliar spray of urea 1% on 30 and 45 days after sowing is recommended. For rice fallow pulses in Delta area, the present recommendation of foliar spray of 2% DAP may be continued.

Economizing the use of micronutrients through seed treatment for greengram

Seed coating with biofertilizers and micronutrients viz., Zn, Mo & Co @ 4,1,0.5 g/kg of seed is recommended.

5. SOWING

Dibble the seeds adopting a spacing of 30 x 10 cm. For bund crop dibble the seeds at 30 cm spacing.

6. WATER MANAGEMENT

Irrigate immediately after sowing, followed by life irrigation on third day. Irrigate at interval of 7 to 10 days depending upon soil and climatic conditions. Flowering and pod formation stages are critical periods when irrigation is a must. Avoid water stagnation at all stages. Apply KCl at 2.0 per cent as foliar spray during vegetative stage if there is moisture stress.

7. FOLIAR APPLICATION

a. Foliar spray of NAA 40 mg/litre and Salicylic acid 100 mg/litre once at pre-flowering and another at 15 days thereafter to reduce flower shedding.

b. i) For rice fallow crops, foliar spray of TNAU Pulse wonder @ 5 kg/ha once at flowering or DAP 20 g/litre once at flowering and another at 15 days thereafter

ii) For irrigated and rainfed crops foliar spray of TNAU Pulse wonder @ 5 kg/ha once at flowering or DAP 20 g/litre or urea 20 g/litre once at flowering and another at 15 days thereafter.

c. Foliar spray of Salicylic acid 100 mg/litre at preflowering and another at 15 days therafter to improve translocation efficiency and seed yield.

8. WEED MANAGEMENT

i) Pre emergence application of Pendimethalin @ 1.0 litres / ha under irrigated condition or PE application of Pendimethalin 0.75 litres per hectare under rainfed condition on 3 days after sowing using Backpack/

Knapsack/Rocker sprayer fitted with flat fan nozzle using 500 litres of water for spraying one ha. After this, one hand weeding on 30th days after sowing gives weed free environment throughout the crop period (or) EPOE application of Quizalofop ethyl @ 50 g ai/ha^{-1} and Imazethapyr @ 50 g ai ha^{-1} on 15 – 20 DAS.

ii) If herbicide is not applied give two hand weedings on 15 and 30 days after sowing.

iii) Apply PE Pendimethalin 30% EC + Imazethapyr 2% EC (Valor 32% EC; Readymix herbicide) @ 1.0 kg a.i. ha^{-1} at 3 DAS.

iv) For the irrigated blackgram PE Isoproturon @ 0.5 kg ha^{-1} followed by one hand weeding on 30 DAS.

9. MULTI BLOOM TECHNOLOGY

A special technology being practiced in Pattukottai block of Tanjore district for blackgram and greengram. The soil is alluvial and rich in organic matter and nutrients. The crop is sown during early summer (Jan.-Feb.) as normal crop and fertilizer is applied as per the recommendation for irrigated crop. In addition to that, top dressing of Nitrogen is done with an extra dose of 25 to 30 kg through urea. Since pulses are indeterminate in growth habit and continue to produce new flushes, the top dressing will be done on 40-45 days after sowing. The crop complete its first flushes of matured pods during 60-65th day and put further second new flush within 20-25 days. Therefore two flushes of pods can be harvested at a time within the duration of 100 days.

CROP PROTECTION

A. Pest management

Economic threshold level for important pests

Pest	ETL
Aphids	20/2.5 cm shoot length
Pod borers	10% of affected pods
Spotted pod borer	3/plant
Stem fly	10%of affected plants
Tobacco cut worm	8 egg masses/100 m

Pests Management strategies

Stem fly *Ophiomyia phaseoli*	Treat seeds with dimethoate 30% EC 5 ml/kg of seed
Aphids *Aphis craccivora*	**Spray any one of the following** Methyl demeton 25% EC 500 ml/ha Dimethoate 30% EC 500 ml/ha

Whitefly *Bemisia tabaci*	**Spray any one of the following** Methyl demeton 25% EC 500 ml/ha Dimethoate 30% EC 500 ml/ha
Tobacco cut worm *Spodoptera litura*	➢ Use of light trap to monitor and kill the attracted adult moths. ➢ Set up the sex pheromone trap at 12/ha to monitor the activity of the pest and to synchronize the pesticide application, if needed, at the maximum activity stage. ➢ Growing castor along border and irrigation bunds. ➢ Removal and destruction of egg masses in castor and cotton crops. ➢ Removal and destruction of early stage larvae found in clusters which can be located easily even from a distance. ➢ Collection and destruction of shed materials. ➢ Hand picking and destruction of grownup caterpillars. **Spray any one of the following insecticides** Chlorpyriphos 20 EC 3750 ml/ha Chlorantraniliprole 18.5% SC @150 ml/ha Flubendiamide 39.35% SC 100ml/ha
Blue butterflies *Lampides boeticus* *Euchrysops cnejus*	**Spray any one of the following insecticides** Chlorantraniliprole 18.5% SC 100ml/ha Flubendiamide 39.35% SC 100ml/ha Lufenuron 5.4% EC 600ml/ha Monocrotophos 36% SL 625 ml/ha Thiodicarb 75% WP 625g/ha
Spotted pod borer *Maruca vitrata*	Monocrotophos 36% SL 437 ml/ha Chlorantraniliprole 18.5% SC 100ml/ha
Pod bugs	Dimethoate 30% EC 500ml/ha Methyl demeton 25% EC 500ml/ha
Storage pests Bruchid- *Callosobruchus chinensis* *C. maculatus*	Dry the seeds adequately to reduce moisture level to 10 %. Use pitfall traps or two in one model trap to monitor the time of emergence of field carried over pulse beetle in storage and accordingly sun-dry the produce. Mix Malathion 5 D 1 kg for every 100 kg seed Pack in polythene lined gunny bags for storage

Disease Management

Seed treatment: Treat the seeds with *T. asperellum* @ 4 g or *P. fluorescens* @ 10 g or carbendazim @ 2 g or thiram @ 4 g/kg of seed

Disease	Recommendations
Powdery mildew: *Erysiphe polygoni*	• Spray NSKE 5% or neem oil 3% twice at 10 days interval from initial disease symptom appearance • Spray 10% Eucalyptus leaf extract at initiation of the disease and 10 days later • Spray Carbendazim @ 500 g or wettable Sulphur 1500 g/ha or Propiconazole 500 ml/ha at initiation of the disease and 10 days later
Rust: *Uromyces appendiculatus*	Spray Mancozeb @ 1000 g or wettable Sulphur 1500 g /ha at initiation of the disease and 10 days later
Leaf spot: *Cercospora canescens*	Spray Carbendazim @ 500 g/ha or Mancozeb @ 1000g /ha at initiation of the disease and 10 days later
Yellow mosaic (Geminivirus) **and** **Leaf crinkle** (Vector: *Bemisia tabaci*)	**Integrated disease management** • Seed treatment with Imidacloprid 600FS @ 5 ml/kg of seeds • Installation of yellow sticky traps @ 12 numbers / ha • Rogue out the virus infected plants up to 45 days • Foliar spray of 10% Notchi leaf extract at 30 DAS or Neem formulation @ 3 ml/l • Spray Methyl demeton 25 EC 500 ml/ha or Dimethoate 30 EC 500 ml/ha or Thiamethoxam 75WG @ 100 g/ha or Iimidacloprid 17.8 SL @ 250 ml/ha or Thiamethoxam 75 WS 1 g /3 lit and repeat after 15 days, if necessary
Leaf curl (Tospovirus) (Vector: *Frankliniella schultzii, Thrips tabaci, Scirtothrips dorsalis*)	
Root rot: *Rhizoctonia bataticola (Macrophomina phaseolina)*	• Seed treatment with *Trichoderma asperellum* @ 4 g/kg or *Pseudomonas fluorescens* @ 10 g/kg • Basal soil application of Zinc sulphate 25 kg/ha • Basal soil application of Neem cake @ 150 kg/ha • Soil application *P. fluorescens* or *T. asperellum* @ 2.5 kg / ha with 50 kg of well decomposed FYM or sand at 30 days after sowing • Spot drench with Carbendazim @ 1 g/ l
Root rot - stem fly complex	Seed treatment with *Beauveria bassiana* + *Pseudomonas fluorescens* @ 5g each/kg of seed

RICE-FALLOWS

VARIETIES AND SEED RATE

	Quantity of seed required kg/ha	
Varieties	Sole crop	Mixed crop
ADT 3	30	-

1. TIME OF SOWING

Third week of January –Second week of February

2. SOWING OF SEEDS

a) For relay cropping broadcast the seeds in the standing crop 5 to 10 days before the harvest of the paddy crop uniformly under optimum soil moisture conditions so that the seeds should get embedded in the waxy mire.

b) For combined harvesting areas, broadcast the seeds before harvesting the paddy crop with machineries

3. FOLIAR APPLICATION

a. Foliar spray of NAA 40 mg/litre once at pre-flowering and another at 15 days thereafter

b. Foliar spray of TNAU pulse wonder @ 5 kg/ha once at flowering or DAP 20 g/lt once at flowering and another at 15 days thereafter

c. Foliar spray of salicylic acid100 mg/litre once at preflowering and another at 15 days thereafter.

4. HARVESTING

i) Picking the matured pods, drying and processing

ii) Uprooting or cutting the whole plants, heaping ,drying and processing

SEED PRODUCTION

GREEN GRAM - VARIETAL SEED PRODUCTION

Land requirement

- Land should be free from volunteer plants. The previous crop should not be of the same variety or other varieties of the same crop. It can be of the same variety if it is certified as per the procedures of certification agency.

Isolation

- For certified / quality seed production leave a distance of 5 m all around the field from the same and other varieties of the crop.

Pre-sowing seed treatment

- Remove all discoloured seeds and use only normal coloured seeds (olive green) for seed purpose.
- Avoid Bruchid infested seeds for sowing.
- If the presence of hard seed percentage exceeds more than 10 %, scarify the seeds with commercial H_2SO_4 for 2 min.
- Harden the Greengram seeds for garden and dry land ecosystem with 100 ppm $MnSO_4$ for 3 h at the ratio of 1:0.3 ratio and dry back to original seed moisture content (8 - 9 %) under shade.

Fertilizer

- NPK @ 25 : 50 : 25 kg + 5 kg TNAU micro nutrient mixture / ha.

Foliar application

- Spray 2 % DAP at the time of first appearance of flowers and second spray 15 days after first spray for enhanced seed set.
- Spray NAA 40 ppm at first flowering and at fortnight interval to reduce the flower drop.
- Spray 0.1 % Brassinoloid on 35^{th} and 45^{th} day after sowing.

Pre-harvest sanitation spray

- Spray (0.05 %) Malathion 50 EC three to five days before harvest to minimize the Bruchid infestation in storage.

Harvest

- Harvest the pods at 30 days after 50 % flowering when majority of the pods (80 %) are brown in colour.
- Harvest the pods as pickings, if the flowering period is longer.
- Dry the pods to 13 to 15 % moisture content.

Threshing

- Thresh the pods either with pliable bamboo stick or pulse thresher.

Drying

- Dry the seeds to 8 - 9 % moisture content.

Seed grading

- Grade the seeds using BSS 7 x 7 wire mesh sieve.
- Discard the discoloured and broken seeds for sowing or storage.

Pre-storage seed treatment

- Treat the seeds with Carbendazim 2 g / kg of seed.
- Treat the seeds with Halogen mixture ($CaOCl_2$ + $CaCO_3$ + *arappu* (*Albizzia amara*) leaf powder mixed in the ratio of 5:4:1 @ 3 g / kg of seed as eco-friendly treatment.

Storage

- Store the seeds with a seed moisture content of 10 - 12 % in gunny or cloth bags for short term storage (8 - 9 months).
- Store the seeds with a seed moisture content of 8 - 9 % in polylined gunny bag for medium term storage (12 - 15 months).
- Store the seeds with a seed moisture content less than 8 % in 700 gauge polythene bag for long term storage (more than15 months).

(iv) COWPEA (*Vigna unguiculata* (L.) Walp.aggreg.)

CLIMATE REQUIREMENT

T_Max°C	T_Min°C	Optimum °C	Rainfall mm	Altitude m MSL
35	15	20 - 30	400 - 600	32

Cowpea is called the "hungry - season crop" because it is the first crop to be harvested before the cereal crops. Cowpea is tolerant of shading and can be combined with tall cereal plants such as sorghum and maize. It is sensitive to waterlogging, though less than other legumes. High moisture may hinder cowpea crops in the sub - humid tropics due to many diseases. Frost can damage the plant during flowering period.

CROP IMPROVEMENT

I. SEASON AND VARIETIES

DISTRICT/SEASON	VARIETIES
Adipattam (June-August) For all districts except Kanyakumari and Nilgiris	Co(CP) 7
Purattasipattam (September - November)	Co(CP) 7, VBN 3