Fertilizer application	:	Urea 15 g and Superphosphate 30 g / pit.
Planting methods	:	Two to three seeds are dibbled per pit and watered. When they grow six inches height one plant may be retained in each pit.
Irrigation	:	Need based
Harvesting	:	If harvested when the pods are tender the beans will be fit for making curry. Each plant will yield two to three kg of green pods at an average seed yield of 750 g to one kg per plant. After the first harvest the branches are pruned and allowed to grow further. In another 45 - 60 days the plants produce the second flush. For pure crop, about 3 kg of seeds may be required.

(ii) BLACKGRAM (*Vigna mungo*)

Climate Requirement

T_Max°C	T_Min°C	Optimum °C	Rainfall mm	Altitude m MSL
40	20	27 - 30	400 – 600	1800

Tropical and subtropicalhot and humid growing season. It is generally grown in kharif/rainy and summer season. Heavy rains during flowering stage are harmful to yield of pea crop.

CROP IMROVEMENT

1. SEASON AND VARIETIES

District/Season	Varieties
Adipattam (June-August) All districts except Kanyakumari and Nilgiris	VBN 6, VBN 8

Puratasipattam (September-November) Vellore, Tiruvannamalai Dharmapuri, Salem, Namakkal, Perambalur, Erode, Coimbatore, Madurai, Dindigul, Theni, Pudukottai, Sivagangai, Ramanathapuram, Virudhunagar, Thoothukudi and Tirunelveli	VBN 6, MDU 1, CO 6, VBN 8, VBN 10
Markazhi – Thaipattam(Winter Irrigated) All districts except Kanyakumari and Nilgiris	VBN 6, CO 6, VBN 8, VBN 10
Rice fallows (January) Thanjavur,Thiruvarur, Nagapattinam, Cuddalore, Villupuram and Kanchipuram	ADT 3, ADT 6, KKM 1, VBN 6, VBN 9
Chithiraipattam (Summer Irrigated) Thanjavur, Thiruvarur, Nagapattinam, Cuddalore, Villupuram, Tiruchirappalli, Perambalur, Thiruvallur, Kancheepuram,	ADT 5, VBN 8

I. DESCRIPTION OF BLACKGRAM VARIETIES

Particulars	VBN 6	VBN 8	VBN 9	VBN 10
Year of Release	2011	2018	2019	2019
Year of Notification	SO.1708(E)/ 26.07.2012	SO.1379(E)/ 27.03.2018	SO.3220(E)/ 05.09.2019	SO.3220(E)/ 05.09.2019
Parentage	Vamban 1 x *Vigna mungo silvestris*	Vamban 3 x VBG 04-008	Mash 114 x Vamban 3	Vamban 1 x UH 04-04
Maturity duration (days)	65-70	65-70	70-75	70-75
Grain yield (kg/ha)	-	-		
Rainfed	850	988	1230	-
Irrigated	890	871	-	1130
Height (cm)	18.6	35-40	35-40	35-40
Hairiness of pods	Hairy	Hairy	Hairy	Hairy
100 grain wt (g)	3.8-4.0	4.5 – 5.0	4.0-5.0	4.0-5.0
Special features	Resistant to Yellow Mosaic, synchronized pod maturity	Resistant to Mungbean Yellow Mosaic Virus (MYMV), leaf crinkle and moderately resistant to powdery mildew diseases	Moderately resistant to Mungbean Yellow Mosaic Virus, Urdbean Leaf Crinkle Virus, Leaf Curl Virus and Powdery mildew diseases	Resistant to Mungbean Yellow Mosaic Virus, Urdbean Leaf Crinkle Virus, Leaf Curl Virus diseases

Particulars	CO 6	ADT 3	ADT 5	ADT 6	MDU 1	KKM 1
Year of Release	2010	1982	1988	2017	2014	2017
Year of Notification	SO.632(E)/25.03.11	SO.596(E)/13.08.1984	SO.793(E)/22.11.1991	SO.1379(E)/27.03.2018	SO.1556(E)/11.06.2015	SO.1379 (E)/ 27.03.2018
Parentage	DU 2 x VB 6	Pure line selection from Thirunelveli local	Pure line selection from Kanpur	Vamban 1 x VBN 04-006	ADB 2003 x VBG 66	COBG 643 X VBN3
Maturity duration (days)	60-65	70-75	65-70	65-70	70-75	65-70
Grain yield (kg/ha)	-	-	-	-	-	
Rainfed	880	720 (Rice fallow)	-	740 (Rice fallow)	-	610 (Rice fallow)
Irrigated	-	-	1545	-	790	-
Height (cm)	30 -35	50	20-25	35-40	30-35	50
Hairiness of pods	Non Hairy	Hairy	Hairy	Hairy	Hairy	-
100 grain wt (g)	5.0 - 6.2	3.5- 4.0	3.5-4.5	4.0-5.0	4.5-5.0	-
Special features	Moderately resistant to YMV disease. Field tolerance to aphids, pod borer and synchronized maturity	Yellow mosaic incidence will be less during Markazhi and Thai pattam	After 65 days second sett of flowering starts	Moderately resistant to MYMV, LCV and PMD	Moderately resistant to MYMV, Non shattering and Non Lodging. Suitable for *Rabi* season. Good battering quality.	-

III. SEED RATE

VARIETIES	Quantity of seed required kg/ha	
	Pure crop	Mixed crop
VBN 6, VBN 8, ADT 5, CO 6, MDU 1	20	10
ADT 3, ADT 6, KKM 1 (Rice fallows)	25	..

Optimum plant population 3,25,000/ha

IV. MANAGEMENT OF FIELD OPERATIONS

1. FIELD PREPARATION

i. Prepare the land to 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 2t /ha along with FYM at 12.5 t/ha or composted coirpith 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.

Note: Seed treatment will protect the seedlings from seed borne pathogens, root-rot and seedlings diseases.

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 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

a) 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 : Mixed black calcareous (Perianackenpalayam series)

Target: 0.9 – 1.0 t ha^{-1}

FN = 10.84T-0.39 SN

FP_2O_5=7.23T-1.00 SP

FK_2O=5.20T-0.04 SK

Initial soil test values (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}			Yield target – 1.0 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	300	13*	25*	13*	13*	28	13*
180	14	325	13*	25*	13*	13*	26	13*
200	16	350	13*	25*	13*	13*	25*	13*
220	18	375	13*	25*	13*	13*	25*	13*
240	20	400	13*	25*	13*	13*	25*	13*

*maintenance dose

Note: FN, FP_2O_5 and K_2O are fertilizer N, P_2O_5 and K_2O in kg ha^{-1}, respectively; T is the yield targe 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}.

b) Soil application of 25 kg $ZnSO_4$/ha under irrigated condition (or) 12.5 kg $ZnSO_4$ on EFYM.

c) 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 kg Fe EDTA per ha.

d) Foliar spray of 1% Urea for yield improvement in black gram.

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

Foliar spraying of 0.5% ZnSO4, 1% FeSO4 + 0.1% citric acid at 30, 45 DAS if the plants shown deficiency symptoms. For yield improvement through increasing the physiological, biochemical attributes, foliar spray of Urea 1% on 30, 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.

e) Foliar spraying to mitigate moisture stress

Foliar spraying of 2% KCl + 100 ppm Boric acid during dry spell as mid season management practice in Black gram during *Rabi* season is recommended to increase the yield over KCl spray alone .

Economizing the use of micronutrients through seed treatment for blackgram

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

Nitrogen substitution by organic sources for pulses

50 per cent nitrogen can be substituted through organic source (850 kg of vermicompost pe hectare). Lime application is recommended for pulses with soil pH less than 6.0.

5. SOWING OF SEEDS

a) For irrigated crop dibble the seeds adopting 30 x 10 cm spacing

b) For rainfed crop dibble the seeds adopting 25 cm x 10 cm spacing

6. WATER MANAGEMENT

Irrigate immediately after sowing, followed by life irrigation on third day. Irrigate at intervals 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 0.5 per cent as foliar spray during vegetative stage if there is moisture stress.

7. FOLIAR APPLICATION

a. Foliar spray of NAA 40 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 to decreases flower shedding.

   ii) For irrigated and rainfed crops, foliar spray of TNAU Pulse wonder @ 5 kg/ha once at flowering

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

8. WEED MANAGEMENT

i) Pre emergence application of Pendimethalin 1.0 litres/ha under irrigated condition, PE application of Pendimethalin 0.75 litres/ha 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 followed by one hand weeding at 20 DAS (or) EPOE application of Quizalofop ethyl @ 50 g ai/ha^{-1} and Imazethapyr @ 50 g ai ha^{-1} on 15 – 20 DAS. If herbicides are not applied give two hand weedings on 15 and 30 days after sowing.

ii) Apply PE Pendimethalin 30% EC + Imazethapyr 2% EC (Valor 32% EC; Readymix herbicide) @ 1.0 kg a.i. ha^{-1} at 3 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 growth habit and continue to produce new flashes, the top dressing will be done on 40-45 days after sowing. The crops complete its first flesh of matured pods during 60-65th day, further their second new flesh within 20-25 days. Therefore two fleshes 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	20nos./2.5 cm shoot length
Pod borers	10% of affected pods
Spotted pod borer	3 larvae/plant
Stem fly	10% of affected plants
Tobacco caterpillar	8 egg masses/100 m

Pest Management strategies

Stem fly *Ophiomyia phaseoli*	Treat seeds with Dimethoate 30% EC 5 ml/kg
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 caterpillar *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 need be, at the maximum activity stage. ➢ Growing castor along with 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
Spotted pod borer *Maruca vitrata*	Thiodicarb 75% WP 625g/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 two-in-one or pitfall traps for monitoring the emergence of field carried over pulse beetle in storage and accordingly sun-dry the produce. • Mix Malathion 5% D 1 kg with 100kgs of seed • Pack in polythene lined gunny bags for storage

B. 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 tabacii*)	**Integrated disease management** • Growing resistant varieties such as VBN 4, VBN 6, VBN 7 and VBN8 • 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 Imidacloprid 17.8 SL @ 250 ml/ha or Thiamethoxam 75 WS 1 g /3 lit and repeat after 15 days, if necessary
Leaf curl (To spovirus) (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

VARIETIES	Quantity of seed required kg/ha Sole crop	 Mixed crop
ADT 3, ADT 6, KKM 1, VBN 6 (Rice fallows)	25	..

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 machinerie

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 pulse wonder @ 5 kg/ha once at flowering to decreases flower shedding and improve yield.

c. Foliar spary of Salicylic acid 100 mg/litre once at prefloweing in another and 15 days there after to improve translocation efficiency and seed yield.

4. HARVESTING

i) Picking the matured pods, drying and processing

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

BLACKGRAM - VARIETAL SEED PRODUCTION

Land requirement

- Land should be free of volunteer plants. The previous crop should not be of the same variety or other varieties of the same crop. It can be 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 for seed purpose.
- If the presence of hard seed percentage exceeds more than 10 %, scarify the seeds with commercial H_2SO_4 for 2 min.
- Harden Blackgram seeds for garden and dry land ecosystem with 100 ppm $ZnSO_4$ for 3 h in 1/3 volume of solution and dry seeds under shade to the original seed moisture content (8 - 9 %)

Fertilizer

- NPK @ 25 : 50 : 25 kg + 5 kg of 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 Malathion 50 EC at 0.05 % three to five days before harvest to minimize the bruchid infestation in storage.

Harvest

- Harvest the pods 30 days after 50 per cent flowering. At this stage, the colour of majority of the pods (80 %) will be black. The pod moisture content will be around 17 - 18 %.
- Harvest the pods as pickings, if the flowering period is longer.
- Dry the pods to 13 to 15 per cent moisture content.

Threshing

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

Drying

- Dry the seeds to 8 - 9 per cent moisture content.

Seed grading

- Grade the seeds using BSS 7 x 7 wire mesh sieve
- Discard the discoloured and broken seeds for seed purpose.
- Avoid bruchid infected seeds for sowing.

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).

(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