

## VARIETAL EVALUATION ON VEGETABLE TYPE COWPEAS FOR LOWER HILLS AND INNER TARAI CONDITIONS OF NEPAL

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### ABSTRACT

The field experiments led by ARS, Malepatan, were conducted during three consecutive fiscal years 2006/07 to 2008/09 in three different locations; Agriculture Research Station (Hort.), Malepatan; National Grain Legume Research Program, Rampur; and National Citrus Research Program, Paripatle. The specific objective of the experiment was to select and recommend high yielding vegetable type cowpea variety for inner Tarai, river basin areas, and lower hill conditions of Nepal. The trial was laid out in Randomize Complete Block Design with three replications in all the years and locations. Among the tested genotype 'IT 86F-2089-5, Green' produced the highest fresh pod yield (7.73 t ha<sup>-1</sup>) followed by genotype 'IT86F-2062-5, White' (7.62 t ha<sup>-1</sup>), and the lowest fresh pod obtained from check cultivar 'Surya' (4.940). Determinate in growth habit, short duration (<90 days), absence of fiber even in ripening period, good cooking quality, and better pod yield genotype 'IT86F-2089-5, green has been purposed to release by the name of 'Malepatan-1' in 2010.

### INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp. ; syn= *Vigna sinensis* Savi] known as *Bodi* is one of the important summer grain legumes. Its tender green pods and shelled immature seeds are used as vegetable and dry seeds as pulse. It is also utilized for fodder and cover crops. In Nepal cowpea is widely grown from Tarai to mid hills for various purposes, such as vegetable, *Daal*, and restoring soil fertility. Total area under legume crops is 319472 ha, within this area minor legume (field pea, cowpea, broad bean, Phaseolus, rice bean, mung bean etc) occupied 30,383 hectares of land only (ABSD, 2010). It is suited for sole crop as well as inter/mixed crop with maize and millet.

Cowpea plays a great role in supplying protein requirement for the rural people. Vegetable type bush cowpea has got popularity in these days as it is successfully grown without using staking and also fit to cultivate nearby city areas. With an objective to select and recommend the high yielding bush vegetable type cowpea cultivar, these experiments were carried out in three consecutive years as a coordinated way in different location across the country.

### MATERIALS AND METHODS

Design: RCBD

Plot size: 9 m<sup>2</sup>

Spacing: 60 cm x 30 cm (two seeds in each hill).

Manure and fertilizer: FYM @ 12 t ha<sup>-1</sup> and 40:60:40 kg N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O/ha,

Usually planting was done in first and second week of March in each year.

Observations: Days to 50% flowering, plant height (cm), pod length (cm), pod diameter (mm), number of seeds per pod, response to disease/ insects, green pod yield, and test weight.



**Table 1.** On-station experiments year and location of cowpea genotypes

Year	Experiment	Location	Source/Reference
2006/07	CVT	ARS (Hort.), Malepatan	Annex 1, Annual Report 2006/07
2006/07	CVT	NGLRP, Rampur, Chitwan	Annex 2, Annual Report 2006/07
2006/07	CVT	NCRP, Paripatle, Dhankuta	Annex 3, Annual Report 2006/07
2007/08	CVT	ARS (Hort.), Malepatan	Annex 4, Annual Report 2007/08
2007/08	CVT	NGLRP, Rampur, Chitwan	Annex 5, Annual Report 2007/08
2007/08	CVT	NCRP, Paripatle, Dhankuta	Annex 7, Annual Report 2007/08
2008/09	CVT	ARS (Hort), Malepatan	Annex 8, Data from ARS, Malepatan
2008/09	CVT	NGIP, Rampur, Chitawan	Annex 9, Data from NGLRP, Rampur
07/08 08/0	CVT	ARS, Malepatan	Annex 9. Disease scoring data book
07-09	CVT	NGLRP, Rampur	Annex 10. Disease score data book
07-09	CVT	NGLRP, Rampur	Annex-11. Insect score data book

## RESULTS AND DISCUSSION

On the basis of experiments conducted in three different locations and years a mean Table has been prepared and explanation has made accordingly. Year wise analyzed data are presented in the Annex (1-8).

**Days to 50% flowering:** Among the tested lines 'IT86F-2062-5, Pkr' (56 days) and 'IT86F-2062-5, White' (59 days) were found relatively early in flowering behavior. Genotype 'IT86F-2014-1' was observed late in flowering (68 days) (Table 2).

**Plant height (cm):** All tested genotypes were determinate type in growth habit. The highest plant height (63.1) was recorded in check cultivar 'Surya' followed by genotype 'IT86F-2014-1' (58.3) and IT86F-2062-5 (Pkr) (Table 2)

**Pod length (cm):** Comparatively longer pod was an indicator of higher fresh pod yield of cowpea. Among the tested genotypes the longest pod (24 cm) was observed in genotypes 'IT86F-2089-5 Green' which produced the highest pod yield among the tested genotypes (Table 2).

**Pod diameter (mm):** Genotype 'IT86F-2089-5 Green' recorded significantly more pod diameter (8.6) than the rest of the lines tested while the significantly the least pod diameter was in 'IT86F-2062-5, White' (7.2) (Table 2).

**Number of seeds per pod:** Number of seeds per pod ranged from 12 to 15 with inconsistent results but the mean number was 13 (Table 2).

**Pod yield ton per hectare:** The genotype 'IT86F-2089-5, Green' produced significantly highest fresh pod yield (7.73) followed by genotype 'IT86F-2062-5, White' (7.62) and the lowest fresh pod obtained from check cultivar 'Surya' (4.940).

**Response to diseases and insects:** Data received from different station and farmers' field revealed that none of the genotypes including 'IT86F-2089-5, Green' suffered from severe attack of any diseases. However, *Cercospora* leaf spots (*Cercospora cruenta*), Mosaic virus (CABMV), Fusarium wilt (*Fusarium oxysporum*) and Colletotricum rot (*Colletotricum* sp.) were recorded from these genotypes. Attack of aphids (*Aphis craccivora*) was more at 2-3 leaf stage in both planting seasons (Shrawan and Falgun). Similar trend was recorded in on-station, on-farm, and even in seed production area of IT86F-2089-5 Green. After pod formation, plant bug (*Anoplocnemis* sp.) and pod borer (*Maruca* sp.) were common in this genotype. It was also noted that less fiber content i.e. succulent mature pod in genotype 'IT86-2089-5, Green' may be the reason of more bug and borer attack as compare to other entries (Annex 10-12).

**Table 2.** Mean physio-morphological and fresh yield related quantitative characters of cowpea genotypes

Characters	Genotypes	CVT	CVT	CVT	Mean
		06/07	07/08	08/09	
Days to 50% flowering	IT86F-2014-1	64.8	73.0	65.3	68
	IT83S-899	62.6	68.5	58.6	63
	IT86F-2089-5 Green	58.5	65.5	56.0	60
	IT86F-2062-5 (Pkr)	49.1	61.5	56.8	56
	IT86F-2062-5(White)	51.5	67.0	58.0	59
	Surya (Check)	61.6	75.0	61.6	66
Plant height (cm)	IT86F-2014-1	-	52.4	91.2	58.3
	IT83S-899	-	598.9	47.7	53.3
	IT86F-2089-5 Green	-	43.0	58.6	50.8
	IT86F-2062-5 (Pkr)	-	46.0	45.5	45.8
	IT86F-2062-5(White)	-	53.0	59.9	56.4
	Surya (Check)	-	51.7	74.6	63.1
Pod length (cm)	IT86F-2014-1	16.3	16.8	16.5	16.5
	IT83S-899	19.4	21.3	19.6	20.1
	IT86F-2089-5 Green	23.0	23.7	25.3	24.0
	IT86F-2062-5 (Pkr)	21.5	20.4	19.9	20.6
	IT86F-2062-5(White)	19.5	18.6	18.8	19.0
	Surya (Check)	17.4	14.7	15.8	16.0
Pod diameter (mm)	IT86F-2014-1	7.2	7.3	7.8	7.4
	IT83S-899	8.0	7.1	7.1	7.4
	IT86F-2089-5 Green	8.6	8.3	8.8	8.6
	IT86F-2062-5 (Pkr)	8.1	7.8	7.2	7.7
	IT86F-2062-5(White)	7.0	7.3	7.3	7.2
	Surya (Check)	7.6	7.1	7.6	7.4
No. of seeds per pod	IT86F-2014-1	12	13	13	13
	IT83S-899	11	14	13	13
	IT86F-2089-5 Green	12	13	15	13
	IT86F-2062-5 (Pkr)	13	12	14	13
	IT86F-2062-5(White)	12	13	14	13
	Surya (Check)	12	12	14	13
Green pod Yield (t/ha)	IT86F-2014-1	7.12	6.06	3.50	5.56
	IT83S-899	6.23	8.48	4.94	6.55
	IT86F-2089-5 Green	6.59	8.95	7.65	7.73
	IT86F-2062-5 (Pkr)	6.86	6.45	5.00	6.10
	IT86F-2062-5(White)	8.37	7.67	6.82	7.62
	Surya (Check)	4.83	5.20	4.81	4.94

**Pattern of stability for fresh pod yield of cowpea**

Genotype and genotype x environment (GGE) bi-plot analysis was conducted using GGE bi-plot software (Yan and Kang, 2002) to determine stability and identify superior genotypes across the environments for CVT. This method defines the position of an ideal genotype, which will have the highest average value of all genotypes and be absolutely stable. The ideal genotype is used as a reference to rank the other genotypes. A performance line passing through the origin of bi-plot is used to determine mean performance of a genotype. The arrow on the performance line represents increasing mean performance. A stability line perpendicular to the performance line also passes through the origin of the bi-plot; the two arrows in opposite directions represent decrease in stability. A genotype closer to the performance line is considered more stable than the one placed farther.



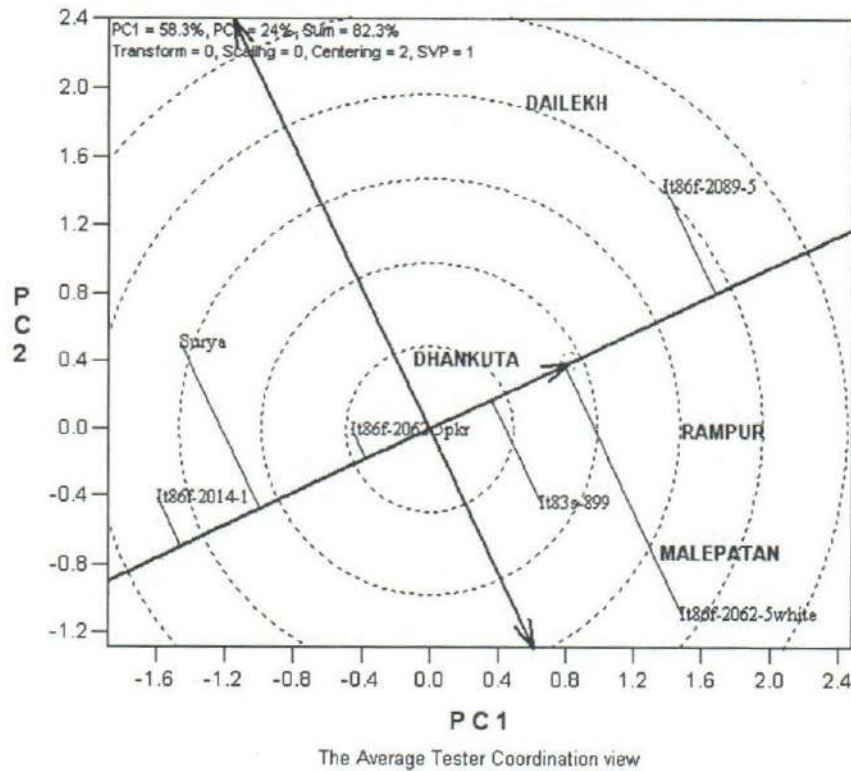


Fig 1. Mean vs. stability pattern for fresh pod yield in CVT, 2006/07-2007/08

### CONCLUSION

Only three determinate types cowpea varieties such as 'Aakash', 'Prakash' and 'Surya' have been released for grain purpose so far and two varieties 'Sarlahi Tane' and Khumal Tane has been released for vegetable purpose. Among the tested genotype 'IT 86F-2089-5 Green' is determinate, short duration (90 days), and suited for rural and urban areas where staking material is scarce. It has long and thick pod size fiberless, good cooking quality, better pod yield, good market price of fresh pod, and maximum seeds and contains 21.58% protein in grains. Suitable in both sole crop as well as inter/mixed crop with maize and millet. Visualizing the major characteristics of this genotypes this cultivar has been released by the name of Malepatan-1 in 2011.

**Annex 1. Performance of cowpea genotypes in CVT at Malepatan, 2006/07**

SN	Treatments	Flowering Days	Pod Length (cm)	No of /plant	Pod Diameter (mm)	Seeds per pod	Pod Yield/Plot (kg)	Yield (t/ha)
1	IT86F-2014-1	54.6	18.66	44.66	7.93	12	6.75	7.29
2	IT83S-899	52.3	19.33	33.00	8.56	10	7.60	8.62
3	<b>IT86F-2089-5 Gre</b>	<b>52.3</b>	<b>22.66</b>	<b>22.66</b>	<b>9.16</b>	<b>11</b>	<b>6.36</b>	<b>7.36</b>
4	IT86F-2062-5 (Pkr)	52.3	21.66	33.00	8.43	13	6.65	7.38
5	IT86F-2062-5(Whi)	54.0	21.33	40.00	7.60	12	10.58	11.75
6	Surya (IT86FD-79)	57.3	15.66	25.33	7.73	11	4.13	4.58
	Grand Mean	53.83	19.88	33.11	8.23	12.0	7.01	
	CV%	3.49	15.70	15.03	6.71	12.22	13.11	
	F-Test	*	NS	**	*	NS	**	
	LSD (0.05)	3.41	-	9.05	1.00	-	1.67	

Source: Annual Technical report ARS (Hort.), Malepatan, 2006/07

**Annex 2. Performance of cowpea genotypes in CVT at Rampur, 2006/07**

SN	Treatments	Flowering Days	Pod Length (cm)	Pod Diameter (mm)	No of Seeds per pod	Pod Yield/Plo (kg)	Yield (t/ha)
1	IT86F-2014-1	-	-	-	-	-	-
2	IT83S-899	52.3	13.3	4.6	10	7.13	7.92
3	<b>IT86F-2089-5 Greel</b>	<b>52.3</b>	<b>22.6</b>	<b>7.7</b>	<b>11</b>	<b>6.71</b>	<b>7.45</b>
4	IT86F-2062-5 (Pokhara)	52.3	21.6	7.7	13	5.81	6.45
5	IT86F-2062-5(White)	54.0	21.3	6.5	12	11.45	12.72
6	Surya (check)	58.5	15.6	7.1	11	5.63	6.25
	Grand Mean	50.00	20.13	6.7	11.53	8.15	
	CV%	28.12	18.85	26.18	13.05	42.04	
	F-Test	NS	NS	NS	NS	NS	
	LSD (0.05)	-	-	-	-	-	

Source: Annual Technical report ARS (Hort.), Malepatan, 2006/07

**Annex 3. Performance of cowpea genotypes in CVT at Dhankuta, 2006/07**

SN	Treatments	Flowering Days	Pod Length (cm)	Pod Diameter (mm)	No of Seeds per pod	Pod Yield/Plot (kg)	Yield (t/ha)
1	IT86F-2014-1	75	14.08	6.4	12	6.09	6.76
2	IT83S-899	73	19.58	7.6	12	3.63	4.03
3	<b>IT86F-2089-5 Greer</b>	<b>64</b>	<b>23.56</b>	<b>8.0</b>	<b>13</b>	<b>5.51</b>	<b>6.12</b>
4	IT86F-2062-5 (Pkr)	46	21.58	7.8	12	5.72	6.35
5	IT86F-2062-5(White)	49	17.86	6.3	12	4.5	4.99
6	Surya (Check).	66	19.22	7.5	13	4.58	5.08
	Grand Mean	62.16	19.90	7.5	12	5.00	
	CV%	22.69	18.15	10.71	6.12	11.53	
	F-Test	**	**	**	NS	**	
	LSD (0.05)	5.87	3.52	0.71	-	1.05	

Source: Annual Technical report ARS (Hort.), Malepatan, 2006/07



**Annex 4. Performance of cowpea genotypes in CVT at Malepatan, 2007/08**

SN	Treatments	Days to Flowering	Days to first Harvest	Plant Height (cm)	Pod Length (cm)	Pod Diameter (mm)	No. of pods/plant	Total No. of pods	Seeds per pod	Pod Yield/Plt (kg)	Yield (t/ha)
1	IT86F-2014-1	83.00	96.00	62.20	16.55	6.80	36.50	1709	13.2	9.37	10.41
2	IT83S-899	82.00	96.00	65.02	24.24	7.35	37.75	1692	13.8	8.21	9.12
3	<b>IT86F-2089-5 Green</b>	<b>69.00</b>	<b>89.00</b>	<b>48.05</b>	<b>25.24</b>	<b>7.77</b>	<b>27.50</b>	<b>1308</b>	<b>12.62</b>	<b>10.18</b>	<b>11.30</b>
4	IT86F-2062-5 (Pkr)	67.00	89.00	51.25	19.51	6.92	33.28	1605	12.45	7.93	8.81
5	IT86F-2062-5 (White)	78.00	96.00	61.08	19.59	6.82	43.75	2016	12.9	10.85	12.05
6	Surya Check	83.00	96.00	58.33	14.67	6.52	12.00	570	11.75	2.16	2.39
	Grand Mean	77.08	93.67	57.65	19.96	7.03	31.79	1483.16	12.82	8.12	
	CV%	3.30	-	6.78	4.62	5.52	23.13	23.39	7.58	21.87	
	F-test	**	NS	**	**	**	**	**	NS	**	
	LSD (0.05)	3.82	-	5.89	1.39	0.58	11.08	523.90	-	2.67	

Source: Annual Technical report ARS (Hort.), Malepatan, 2007/08

**Annex 5. Performance of cowpea genotypes in CVT at Rampur, 2007/08**

SN	Treatments	Plant Height (cm)	No. of pods/plan	Pod Length (cm)	Pod Diameter (mm)	Seeds per pod	Pod Yield/P (kg)	Yield (t/ha)
1	IT86F-2014-1	45.00	13.33	18.66	8.00	13.66	3.04	3.37
2	IT83S-899	59.00	17.33	20.33	6.66	16.00	12.62	14.02
3	<b>IT86F-2089-5 Green</b>	<b>45.00</b>	<b>12.66</b>	<b>24.66</b>	<b>9.00</b>	<b>15.66</b>	<b>7.28</b>	<b>8.08</b>
4	IT86F-2062-5 (Pokhara)	48.00	13.33	23.66	9.33	14.00	4.47	4.96
5	IT86F-2062-5 (White)	49.00	16.33	20.00	8.33	15.00	7.38	8.19
6	Surya (IT86FD-792), Ch.	51.00	22.33	16.00	8.33	13.00	6.04	6.71
	Grand Mean	49.50	15.88	20.55	8.27	14.55	5.82	
	CV%	7.33		9.17	7.20		30.14	
	F-Test	*		**	**		NS	
	LSD (0.05)	6.54		3.43	1.085		-	

Source: Annual Technical report ARS (Hort.), Malepatan, 2007/08

**Annex 6. Performance of cowpea genotypes in CVT at Dhankuta, 2007/08**

SN	Treatments	Days to 50% flowering	Pod length (cm)	Pod diameter (cm)	Grains/pod (no)	Pod Yield per Plot (kg)	Yield (t/ha)
1	IT86F-2014-1	63	15.3	7.3	12	4.8	5.33
2	IT83S-899	55	19.3	7.3	13	4.5	4.99
3	<b>IT86F-2089-5 Green</b>	<b>62</b>	<b>21.3</b>	<b>8.1</b>	<b>10</b>	<b>5.8</b>	<b>6.44</b>
4	IT86F-2062-5 (Pokhara)	56	18.3	7.1	11	5.3	5.88
5	IT86F-2062-5 (White)	54	16.3	6.8	11	4.8	5.33
6	Surya (IT86FD-792), Ch.	67	13.6	6.4	12	5.0	5.55
	Grand Mean	59.55	17.38	7.18	11.38	5.08	
	CV%	21.15	6.78	4.98	10.47	8.48	
	F-Test	NS	**	**	NS	*	
	LSD (0.05)	-	2.13	0.64	-	0.18	

Source: Annual Technical report ARS (Hort.), Malepatan, 2007/08

**Annex 7. Performance of cowpea genotypes in CVT at Malepatan, 2008/09**

SN	Treatments	Flowering Days	Pod Length (cm)	Pod Diameter (mm)	Seeds per pod	Pod Yield Per Plot (kg)	Yield (t/ha)
1	IT86F-2014-1	76.5	17.2	7.0	13	4.80	5.33
2	IT83S-899	73.5	22.4	6.6	13	6.79	7.54
3	<b>IT86F-2089-5 Green</b>	<b>69.2</b>	<b>24.3</b>	<b>8.8</b>	<b>15</b>	<b>9.16</b>	<b>10.17</b>
4	IT86F-2062-5 (Pokhar	70.2	21.8	6.9	14	7.07	7.85
5	IT86F-2062-5(White)	72.0	20.3	7.0	14	8.34	9.26
6	Surya (check)	77	16.6	6.3	14	5.65	6.27
	Grand Mean	73.0	20.4	7.13	14	6.97	
	CV%	2.56		4.36	5.58	12.60	
	F-Test	**	**	**	*	**	
	LSD (0.05)	2.82	1.96	0.469	1.16	1.32	

Source: Field data book, ARS (Hort.), Malepatan

**Annex 8. Performance of cowpea genotypes in CVT at Rampur, 2008/09**

SN	Treatments	Flowering Days	Pod Length (cm)	Pod Diameter (mm)	Seeds per pod	Pod Yield Per Plot (kg)	Yield (t/ha)
1	IT86F-2014-1	54	15.6	8.5	-	1.49	1.65
2	IT83S-899	44	17.0	7.4	-	2.09	2.23
3	<b>IT86F-2089-5 Green</b>	<b>43</b>	<b>25.1</b>	<b>5.8</b>	-	<b>6.56</b>	<b>7.28</b>
4	IT86F-2062-5 (Pokhar	44	18.0	7.8	-	3.57	3.96
5	IT86F-2062-5(White)	44	16.0	7.6	-	3.93	4.36
6	Surya (check)	46	14.8	8.7	-	2.99	3.32
	Grand Mean	45.6	17.9	7.7	-	3.4	
	CV%	1.65	6.51	24.7	-	17.24	
	F-Test	**	**	NS	-	**	
	LSD (0.05)	1.37	2.12	-	-	1.07	

Source: Field data book, NGLRP, Rampur, Chitawan

**Annex 9. Disease scoring of the tested genotypes**

Genotypes	2007/08				2008/09			
	Cercospora Leaf spot (1-9 scale)*	Rhizoctonia collar rot (Incidence %)	Mosaic Virus Incidence (%)	Virus Severity**	Cercospora Leaf spot (1-9 scale)*	Colletotrichum (Incidence %)	Mosaic Virus Incidence	Virus Severity
IT86F-2014-1	1	1	4.5	++	-	1	5.5	++
IT83S-899	1	2.0	8	++	-	2.5	11	++
<b>IT86F-2089-5 Green</b>	<b>2</b>	<b>0.5</b>	<b>1</b>	<b>+</b>	<b>2</b>	<b>0.5</b>	<b>1</b>	<b>+</b>
IT86F-2062-5 (PKF	1	3	2.5	++	-	3	2.5	++
IT86F-2062-5(Whit	2	-	10	++	2		15.2	++
Surya (Check).	1	1.5	2.5	+	-	1.5	2.5	+

\*1= No disease, 9 = completely damage by disease

\*\* + = Low, ++ = Mild, +++ = Medium ++++ = High



**Annex 10. Disease scoring of the tested genotypes**

Genotypes	2006/07			2007/08			2008/09		
	Nematode (1-5)	Fusarium (1-9)	Mosaic Virus (1-5)	Nematode (1-5)	Fusarium	Mosaic Virus	Nematode (1-5)	Fusarium	Mosaic Virus
IT86F-2014-1	2	3	3.0	2	6	1	2	3	1
IT83S-899	3	3	2.0	1	4	1	3	3	3
<b>IT86F-2089-5 Green</b>	<b>2</b>	<b>2</b>	<b>1.0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>
IT86F-2062-5 (PKF)	2	3	1.0	1	4	1	2	3	1
IT86F-2062-5 (White)	2	3	1.0	1	4	1	2	3	2
Surya (Check).	3	3	3.0	2	4	1	3	3	2

Source: Annual technical report 2007/08 and field data book, NGLRP, Rampur, Chitwan

**Annex 11. Response of cowpea genotypes to insects' damage at Rampur (1-9 scale)**

Genotypes	2006/07				2007/08				2008/09			
	Cutworm	Aphid	Pod fly	Pod bore	Cutworm	Aphid	Pod fly	Pod bore	Cutworm	Aphid	Pod fly	Pod bore
IT86F-2014	3	1	2	1	3	3	2	3	3	3	2	2
IT83S-899	3	1	2	2	5	4	4	3	3	3	2	3
<b>IT86F-2089-5 Green</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
IT86F-2062 (PKR)	3	1	3	1	3	3	4	2	3	2	3	3
IT86F-2062-5 (White)	4	1	3	3	5	5	4	2	4	2	3	3
Surya (Check)	2	1	3	4	2	2	2	2	2	2	3	2

Source: Annual technical report, 2007/08 and field data book, NGLRP, Rampur, Chitwan

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