

## 2. Forage and dual-purpose sorghums

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Data tables in Book 2 of 3  
Forage: 229-293  
Dual-purpose: 50-79

### Contents

Summary .....	2
A. Breeding and quality.....	2
B. Agronomy and quality.....	3
C. Animal nutrition .....	4
Forage sorghum 2007-08: Detailed Report.....	4
Forage breeding and quality.....	5
Trial 1: Advanced varietal trial (Single-cut) .....	5
Trial 2: Initial varietal trial (Single-cut) .....	6
Trial 3: Advanced Hybrid/ varietal trail (Multi-cut).....	7
Trial 4: Initial Hybrid/ Varietal Trial (Multi-cut) .....	9
Trial 5: Advanced seed yield trial (Hisar, Pantnagar, Delhi, Ludhiana) .....	9
Forage agronomy and quality.....	10
Trial 6: Response of single cut forage sorghum genotypes to different N levels (Hisar, Udaipur, Pantnagar).....	10
Trial 7: Effect of INM on yield and quality of single cut forage sorghum (Hisar, Udaipur, Pantnagar, Ludhiana) .....	10
Trial 8: Intercropping studies on single cut forage sorghum (Pantnagar).....	11
Trial 9: Response of multicut Forage Sorghum hybrids/varieties under different nitrogen levels (Hisar, Udaipur, Pantnagar, Ludhiana) .....	11
Trial 10: Integrated nutrient management studies in forage sorghum based cropping system (Hisar, Pantnagar)...	12
Animal nutrition .....	13
Trial 11: Nutritional evaluation of single cut forage sorghum genotypes SRF 305, UTFS 49 against check variety HC 308 in cross bred calves (Hisar) .....	13
Trial 12: Chemical composition, in vitro and in sacco studies of multicut forage sorghum strains at different cuts (Hisar) .....	14
Trial 13: Assessment of sorghum grain as an alternate source of energy in the ration of calves (Hisar) .....	14
Forage entomology and pathology .....	15
Dual-purpose sorghum trials.....	15
Summary.....	15
Dual purpose sorghum 2007-08: Detailed report.....	16
Advanced Varietal Hybrid Trial .....	16
Initial Varietal Trial.....	18

## Summary

During 2007-08, a total of 15 experiments were carried out across 17 locations, comprising of two zones (zone I- 10 locations in North India and zone II- 6 locations in rest of India). The experiments include:

Breeding trials: 5

Agronomy trials: 5

Trials on animal nutrition: 3

There was one entomology and one pathology trial also, but since the data was recorded in breeding trials only, the results are incorporated into breeding trials. The most important findings for the year are mentioned below.

## A. Breeding and quality

### Single-cut

#### **Trial 1: Advanced varietal trial (Single-cut)**

- **Entries:** Eight genotypes along with 2 checks (HC 308 and CSV 15).
- **Over all locations:** The genotype, PC 1003 ranked first both for green (408.5 q/ha) fodder and dry fodder (157.1 q/ha) yields. For green fodder yield SRF 305 ranked second (406.7 q/ha), whereas for dry fodder yield it ranked third (150.0 q/ha).
- **Zone I:** In Zone I also PC 1003 performed well for both green and dry fodder yields.
- **Zone II:** NFS 2 ranked first for green fodder yield, followed by SRF 305. For dry fodder yield, S 541 was the best genotype followed by PC 1002 and PC 1003.

**Conclusions** The genotype, SRF 305 performed well over three years (2005-07). For fodder quality parameters, the genotype PC 1003 was found to be superior compared to all test entries (it ranked first in protein content and IVDMD values).

#### **Trial 2: Initial varietal trial (Single-cut)**

- **Entries:** 4 varieties along with two checks (HC 308 and CSV 15).
- **Over all locations:** The genotype SU 1175 ranked first for green (431.1 q/ha) as well as dry (176.6 q/ha) fodder yields. For green and dry fodder yields per day also SU 1175 was the best genotype. Highest protein percentage was noticed in CSV 15 (8.17%) followed by UTFS 51 (8.13%). For IVDMD and TSS, UTFS 51 was ranking first. But none of the genotypes could surpass the checks for protein yield and DDM values.
- **Zone I:** None of the genotypes could out yield the check HC 308 (425.4 q/ha) for green fodder yield, however only SU 1175 (150 q/ha) could out yield HC 308 (149.2 q/ha) for dry fodder yield.
- **Zone II:** SU 1175 was standing first for green and dry fodder yields.

**Conclusions:** SU 1175 was the best genotype as far as the green and dry fodder yields are concerned.

### Multi-cut

#### **Trial 3: Advanced Hybrid/ varietal trail (Multi-cut)**

- **Entries:** Four hybrids and 2 two varieties, one check variety, SSG 59-3 and one check hybrid, CSH 20MF.
- **Over all locations:** The hybrid UTMCH 1302 ranked first for green fodder yield (794.7 q/ha). For dry fodder yield, the check CSH 20MF was the highest yielder followed by UTMCH 1302 and UTMCH 1304. The average protein content of the two cuts ranged from 7.55% to 8.96%. All the four hybrids and two varieties showed higher protein percentage compared to their respective checks. The average protein yield was highest in the genotype, UTMCH 1302, followed by UTMCH 1304. Among the varieties, JHV 14 showed highest protein yield followed by the check, SSG 59-3. The average IVDMD percentage of two cuts on all India basis ranged from 43.77% to 49.9% (UTMCH 1304). The second best hybrid for IVDMD percent was UTMCH 1302 (45.4%). Among the varieties, UTMCH 534 (46.43%) was the best, followed by the check, SSG 59-3 (45.4%).
- **Zone I:** UTMCH 1302 out yielded the check, CSH 20MF (781q/ha) for green fodder yield (814 q/ha). For dry fodder yield, it was in the second position after CSH 20MF.
- **Zone II:** None of the hybrids could out yield the check, CSH 20MF for green fodder yield, but for dry fodder UTMCH 1304 (184.6 q/ha) was the highest yielder. The variety UTMCH 534 recorded high green and dry fodder yields along with more green and dry fodder yields per day compared to the check, SSG 59-3.

**Conclusions:** Considering the yield components, UTMCH 1302 was the best hybrid followed by UTMCH 1304 and GK 909. Considering the quality characters, UTMCH 1302 followed by UTMCH 1304 among the hybrids, and UTMCH 534 among the varieties were the best. The hybrid, UTMCH 1302 performed well over four years (2004-07).

#### **Trial 4: Initial Hybrid/ Varietal Trial (MC)**

- **Entries:** Two varieties and 4 hybrids, the check variety, SSG 59-3 and the check hybrid, CSH 20MF.
- **Over all locations:** The hybrid, UTMCH 1305 out yielded the check, CSH 20MF for both green (711.1 q/ha) and dry (182.8 q/ha) fodder yields. UTMCH 1305 ranked first for green fodder yield per day and dry fodder yield per day also. The hybrid, UTMCH 1305 (15.6% DH) recorded significantly low level of shoot fly incidence

over the check hybrid, CSH 20MF (18.6% DM). The average protein content varied from 6.86% to 8.96% (ARFSH 559). The protein yield ranged from 11.05 q/ha (HH 386) to 17.92 q/ha (UTMCH 1305). For DDM value, UTMCH 1305 was the best genotype (127.4 q/ha). None of the varieties were found to out yield the check, SSG 59-3 either for green or dry fodder yields.

- **Zone I:** The hybrid, UTMCH 1305 ranked for all the yield traits and quality traits like protein yield and DDM.
- **Zone II:** ARFSH 559 ranked first for green fodder yield. For green and dry fodder Yields per day also ARFSH 559 topped.

**Conclusions:** UTMCH 1305 and ARFSH 559 were found to be better genotypes as far as quality parameters are concerned.

#### **Trial 5: Advanced seed yield trial**

- **Entries:** 8 entries and two checks (HC 308 and CSV 15) in 4 locations
- **Highlights of results:** CSV 15 ranked at the top in seed yield followed by PC 1002 and UTFS 49.
- The genotype CSV 15 took minimum days to maturity followed by UTFS 49, SRF 305, SU 1211 and S 541

**Conclusion:** All the entries produced seed on par with the check.

## **B. Agronomy and quality**

#### **Trial 6: Response of single cut forage sorghum genotypes to different nitrogen levels**

- **Treatments:** 3 genotypes, 3 nitrogen levels at 3 locations
- **Highlights of results:** There was no significant interaction between cultivar and fertilizer input across all the observations.
- The nitrogen variability influenced the dry fodder production and the associated characters like tillers & green leaves per hill (plant) as well as the stem girth.
- The dry fodder yield across nitrogen rates increased with increasing rate of nitrogen application.
- The protein yield with the highest rate of nitrogen (N) application was 12 q ha<sup>-1</sup> indicating that direct link between protein and N.
- **Conclusion:** Comparison of yields across three nitrogen rates indicated that the application rates of 100 kg/ha (dry fodder yield 152 q ha<sup>-1</sup>) and 120 kg/ha (171 q ha<sup>-1</sup>) were significantly higher than 80 kg N ha<sup>-1</sup> (128 q ha<sup>-1</sup>).

#### **Trial 7: Effect of INM on yield and quality of single cut forage sorghum**

- **Treatments:** 8 Treatment combinations of organic and inorganic source of nutrients at 3 locations
- **Highlights of results:** The highest green and dry fodder yields of 621 & 167 q ha<sup>-1</sup> respectively were attained with application of 100% RDF and 25 kg Zinc Sulphate.
- The protein percentage is higher (6.35%) when the recommended dose of fertiliser is partly replaced by vermicompost.

**Conclusion:** All combinations of external inputs whether from organic or inorganic source had significant influence on quantity and quality observations. The highest green and dry fodder yield were attained by the application of 100% RDF and 25kg/ha zinc sulphate.

#### **Trial 8: Intercropping studies on single cut forage sorghum**

- **Treatments:** 9 treatment combinations including 3 sole crops of forage sorghum, pillipesara and cowpea, and 6 treatments of forage sorghum with intercrop of pillipesara and cowpea in 3 different row proportions of 1:1, 2:1 & 2:2 at Pantnagar
- **Highlights of results:** Sorghum and pillipesara grown in 1:1 ratio had given high total green fodder yield (662.6 q/ha) followed by sorghum and cowpea in 1:1 ratio (656.6 q/ha).
- The highest dry fodder yield was given by sorghum and pillipesara in 2:2 ratio followed by sorghum and cowpea in 1:1 ratio.

**Conclusion:** Sorghum and pillipesara in 1:1 ratio was found to be most profitable with a cost-benefit ratio of 2.36.

#### **Trial 9: Response of multicut forage sorghum hybrids/varieties under different nitrogen levels**

- **Treatments:** 4 multi-cut cultivars, 4 nitrogen levels at 4 locations
- **Highlights of results:** Green fodder yield from all the three cuts was found to be significantly higher with 150 kg N ha<sup>-1</sup> application as compared to all other levels.
- For dry fodder yield, the total yield increased significantly with the increasing levels of nitrogen from 0 to 150 kg/ha.

**Conclusion:** There was no significant interaction between cultivar and fertilizer input across all the observations.

#### **Trial 10: Integrated nutrient management studies in forage sorghum based cropping system**

- **Treatments:** 8 Treatments with different combinations of organic, inorganic and biofertilizers at 2 locations
- **Highlights of results:** The highest total green fodder over locations was obtained from the treatment 75% RDF + Azospirillum and total highest dry fodder was obtained from the treatment, 75% RDF + 25%N through FYM.
- The protein percentage and IVDMD percentage was found to be highest in the treatment, 75% RDF + Azospirillum.
- The total protein yield and DDM were highest in 75% RDF + 25% N through FYM.

**Conclusion:** Biofertilizer treatment showed a variable response of different observations in combination with or without FYM. Total highest green fodder and high protein and IVDMD per cent were obtained from the treatment, 75% RDF + Azospirillum.

### **C. Animal nutrition**

#### **Trial 11: Nutritional evaluation of single cut forage sorghum genotypes SRF 305, UTFS 49 against check variety HC 308 in cross bred calves**

- **Treatments:** Two varieties fed to two groups of animals at Hisar
- **Highlights of results:** The chemical constituents of two varieties of sorghum showed that average crude protein was higher in HC-308 as compared to UTFS-49 and crude fibre, NDF, ADF, Cellulose and lignin contents were higher in UTFS-49.
- The mean values of crude protein intake per day were significantly ( $P < 0.05$ ) higher in calf groups fed with fodder of HC-308 (156.40g) as compared to group fed with UTFS-49 fodder (137.06g).
- Digestible crude protein and total digestible nutrient intake were significantly ( $P < 0.05$ ) higher by feeding HC-308 fodder as compared to UTFS-49.

**Conclusion:** Sorghum fodder from HC-308 was nutritionally better than UTFS-49 in terms of nutrients intake, nutrients utilization, nutritive value and total digestible nutrients.

#### **Trial 12: Chemical composition, *in vitro* and *in sacco* studies of multicut forage sorghum strains at different cut**

- **Treatments:** 93 sorghum genotypes along with the check variety, SSG 59-3 at Hisar
- **Highlights of results:** The newly developed genotypes/strains G 48 1/7, G 161 1/28, G 162 1/29, G-165 1/32, G-191 2/22, G-199, 2/26, S-533 3/7, S-534 3/8, S-536 3/9, IS-65 13/13, IS-1032 3/15, IS 3225 3/13, IS-4718 3/37, IS -5413 3/34, SRF -285 5/8, UTFS-43 5/42, EJ -66-1 4/27, UTMCH-1302, WT-51 4/15, EJ -66 4/27, PC 2RG 5/15, UTFS-37 5/9, EJ-167 2/3, EJ104 4/17 and HV11 4/7 were superior sorghum fodder strain over check variety SSG 59-3.

**Conclusion:** 26 genotypes with superior fodder quality over SSG 59-3 were identified.

#### **Trial 13: Assessment of sorghum grain as an alternate source of energy in the ration of calves**

- **Treatments:** Eight crossbred calves having average body weight of 90 kg in two groups, G-I and G-II, of four each.
- **Highlights of results:** Calves of G-I are feeding maize grain (as an energy source) based concentrate mixture while of G-II are feeding sorghum grain (as energy source) based concentrate mixture.
- The experiment is in progress.

### **Forage sorghum 2007-08: Detailed Report**

During 2007-08 emphasis continued to be given on identification of genotypes with improved fodder yield and quality involving different disciplines like breeding, agronomy, entomology, plant pathology, quality and nutrition. The improved genotypes were contributed by various SAUs, ICAR institutes and private organizations for their evaluation at all India level under different eco-geographical regions of the country. The performance of test genotypes was evaluated at all India level as well as in two zones.

Zone I: Western UP, Uttaranchal, Delhi, Gujarat, Rajasthan, Haryana, Punjab and Bihar

Zone II: Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh and Tamil Nadu

Zone I is characterized by the areas where sorghum is utilized as fodder whereas Zone II involves the states where grain and dual purpose sorghums are mainly grown. During kharif 2007, following co-ordinated trials were conducted at 17 locations. The trials conducted as per technical programme of kharif 2007 are listed below:

#### A. Breeding and Quality

- Trial 1: Advanced Varietal Trial on Forage Sorghum (single cut)
- Trial 2: Initial Varietal Trial on Forage Sorghum (single cut)
- Trial 3: Advanced Hybrid/Varietal Trial on Multicut Forage Sorghum
- Trial 4: Initial Hybrid/Varietal Trial on Multicut Forage Sorghum
- Trial 5: Advanced Seed Yield Trial (Single cut)

#### B. Agronomy and Quality

- Trial 6: Response of Single cut forage sorghum genotypes to different nitrogen levels
- Trial 7: Effect of INM on yield and quality of single cut forage sorghum
- Trial 8: Intercropping studies on single cut forage sorghum
- Trial 9: Response of multicut forage sorghum hybrids/varieties under different Nitrogen levels
- Trial 10: Integrated nutrient management studies in forage sorghum based cropping System

#### C. Animal nutrition

- Trial 11: Nutritional evaluation of single cut forage sorghum genotypes SRF 305, UTFS 49 against check variety HC 308 in cross bred calves
- Trial 12: Chemical composition, *in vitro* and *in sacco* studies of multicut forage sorghum strains at different cuts
- Trial 13: Assessment of sorghum grain as an alternate source of energy in the ration of Calves

#### D. Plant pathology

- Trial 14: Evaluation of all the entries of forage sorghum against foliar diseases in breeding trials

#### E. Entomology

- Trial 15: Evaluation of all the entries of forage sorghum genotypes in breeding trials against shoot fly and stem borer.

Since the entomology and pathology trials were not conducted separately, the results on pests and diseases are included in the breeding trials. The results of these trials are presented hereunder:

### Forage breeding and quality

All India Coordinated single cut trials on Forage Sorghum: These trials were sent to 16 locations out of which 13 locations conducted these trials. Urulikanchan and Izatnagar did not conduct the trials.

#### Trial 1: Advanced varietal trial (Single-cut)

**Breeding:** The data from advanced varietal trial on single cut forage (Tables 1.1 to 1.15) indicated that PC 1003 ranked at top both for green fodder (408.5 q/ha) and dry fodder (157.1 q/ha) yields. For green fodder yield, PC 1003 was followed by SRF 305 (406.7 q/ha), whereas for dry fodder yield, it was followed by UTFS 49 (150.6 q/ha) and SRF 305 (150.0 q/ha) on all India average basis. In Zone I also PC 1003 performed well for both green (422 q/ha) and dry (154.7 q/ha) fodder yields. In Zone I, PC 1003 was followed by SRF 305 (415.8 q/ha) and UTFS 49 (402.6 q/ha). For dry fodder yield it was followed by UTFS 49 (153.5 q/ha) and SRF 305 (149.3 q/ha). In Zone II, NFS 2 ranked first (411.7 q/ha) for green fodder yield, followed by SRF 305 (415.8 q/ha) and SPV 1616 (378.3 q/ha). For dry fodder yield in Zone II, S 541 was the best genotype (177.7 q/ha) followed by PC 1002 (165.4 q/ha) and PC 1003 (165.2 q/ha). As far as GFY/day is concerned SRF 305 (5.23 q/ha) was the best genotype followed by PC 1003 (5.04 q/ha). For DFY/day also SRF 305 (1.94 q/ha) was the best genotype followed by PC 1003 (1.91 q/ha) and UTFS 49 (1.89 q/ha). For shoot fly resistance, the check HC 308 recorded the lowest incidence (13.6% deadhearts (DH)) and all the other genotypes are statistically on par with HC 308. For stem borer, all the genotypes recorded significantly higher incidence compared to the check, HC 308 (14.8% DH). With reference to foliar diseases, S 541, UTFS 49 and SRF 305 showed multiple resistance, and were on par with the checks (Table 3.24). The following table shows the performance of better genotypes in this trial.

**Table 1. Performance of promising single-cut sorghum genotypes in advanced trial during 2007-08 (Entries- 8; Checks- 2; Locations: 13)**

All India Average																				
Yield										Quality				Insect pests DH (%)		Diseases (score)				
Entry	GFY (q/ha)			DFY (q/ha)			GFY/day (q/ha)		DFY/day (q/ha)		PY (q/ha)		DDM (q/ha)		SF	SB	ZLS	ALS	GLS	SS
	R	% +/-		R	% +/-		R		R		R		R							
PC 1003	408.5	1	5.66	157	1	13.02	5.04	2	1.91	2	86	1	53.4	2	17	17.9	2.44	3.44	3	1
SRF 305	406.7	2	5.20	150	3	7.91	5.23	1	1.94	1	78	6	47.4	4	15.2	18.6	2.22	2.11	2	1
UTFS 49	380.6	4	-1.55	151	2	8.35	4.86	5	1.89	3	86	2	56.6	1	15	18.9	2.11	2.45	1	2
Best check																				
HC 308	386.6	3		139	6		4.99	3	1.77	7	82	3	46.7	5	13.6	14.8	2.11	2.56	1	2
CD (5%)	47.5			19.4			0.84		0.36		32		19.3		9.5	2.5	1.42	0.67	0	0
CD (1%)	63.1			25.7			1.11		0.48		44		26.7		13.8	3.5	1.95	0.97	0	0
C.V. (%)	14.36			17.4			17.6		21.9		26.1		25.6		15.1	5	34.6	9.93	0.1	0

GFY- Green fodder yield, DFY- Dry fodder yield, PY- Protein yield; DDM- Digestible dry matter, DH- deadhearts, SF- Shoot fly, SB- Stem borer, ZLS- Zonate leaf spot, ALS- Anthracnose leaf spot, GLS- Grey leaf spot, SS- Sooty stripe

The performance of promising genotypes tested in All India Co-ordinated trials during last 23 years is presented in the following table:

**Table 2. Performance of promising single cut sorghum genotypes tested in AICSIP over last 3 years**

Entry	Year	Yield						Quality				Insect pests DH (%)		Diseases (score)					
		GFY (q/ha)	DFY (q/ha)	GFY/day (q/ha)	DFY/day (q/ha)	PY (q/ha)	DDM (q/ha)	SF	SB	ZLS	ALS	GLS	SS						
SRF 305	2005*	407.8	1	115.4	1	5.29	1	1.48	1	7.30	2	62.8	3	22	19	20	1.2	1.7	1.5
	2006	364.2	1	107.6	2	4.93	1	1.42	2	10.58	2	57.1	2	17	16	23	2.2	1.0	2.0
	2007	406.7	2	150.0	3	5.23	1	1.94	1	7.8	6	47.4	4	15.2	18.6	2.22	2.11	2.00	1.00
	<b>Av</b>	<b>392.9</b>		<b>124.3</b>		<b>5.15</b>		<b>1.61</b>		<b>8.56</b>		<b>55.8</b>		<b>18.1</b>	<b>17.9</b>	<b>2.17</b>	<b>1.84</b>	<b>1.57</b>	<b>1.5</b>
PC 1003	2006*	365.6	3	111.2	2	4.62	4	1.49	4	10.3	3	46.3	1	16.2	14.9	28	2.6	2.5	1.0
	2007	408.5	1	157.1	1	5.04	2	1.91	2	8.6	1	53.4	2	17.0	17.9	2.44	3.44	3.00	1.00
	<b>Av</b>	<b>387.1</b>		<b>134.1</b>		<b>4.83</b>		<b>1.70</b>		<b>9.45</b>		<b>49.8</b>		<b>16.6</b>	<b>16.4</b>	<b>2.62</b>	<b>3.02</b>	<b>2.75</b>	<b>1.00</b>
UTFS 49	2006*	354.9	5	103.1	4	4.61	5	1.47	5	8.97	6	45.6	2	17.6	14.8	24	2.1	1.0	3.0
	2007	380.6	4	150.6	2	4.86	5	1.89	3	8.6	2	56.6	1	15.0	18.9	2.11	2.45	1.00	2.00
	<b>Av</b>	<b>367.7</b>		<b>126.8</b>		<b>4.73</b>		<b>1.68</b>		<b>8.78</b>		<b>51.1</b>		<b>16.3</b>	<b>16.8</b>	<b>2.25</b>	<b>2.27</b>	<b>1.00</b>	<b>2.5</b>
Best check																			
HC 308	2005	253.2	9	65.2	9	3.18	9	0.83	8	4.54	8	31.7	9	17	16	1.0	1.7	2.0	1.5
	2006	349.1	4	101.9	4	4.78	2	1.37	3	10.11	3	47.6	3	13	16	10	2.1	2.3	2.0
	2007	386.6	3	139.0	6	4.99	3	1.77	7	8.2	3	46.7	5	13.6	14.8	2.11	2.56	1.00	2.00
	<b>Av</b>	<b>329.6</b>		<b>102.0</b>		<b>4.32</b>		<b>1.32</b>		<b>7.62</b>		<b>42.0</b>		<b>14.5</b>	<b>15.6</b>	<b>1.37</b>	<b>2.12</b>	<b>1.77</b>	<b>1.83</b>

**Quality:** Eight genotypes along with two standard checks, HC 308 and CSV 15 were analyzed for quality at 6 locations. The data (Tables 1.16 to 1.17) revealed that protein content varied from 7.94 to 8.58 percent, the highest being in HC 308 (8.58%) closely followed by PC 1003 (8.53%). On all India basis protein yield (q/ha) varied from 4.7 (NFS 2) to 8.6 (PC 1003). The average IVDMD of five locations varied from 42.0 (S 541) to 47.6% (PC 1003), while average DDM yield ranged from 27.9 q/ha (NFS 2) to 56.6 q/ha (UTFS 49). Considering all the quality parameters, the genotype PC 1003 was found to be superior as it ranked first in protein content and IVDMD values. The average HCN content of two locations ranged from 56.3 to 139.6 ppm which is within the safe limit of <200ppm. TSS content ranged from 7.9% (SU 1211) to 17% (S 541).

### Trial 2: Initial varietal trial (Single-cut)

**Breeding:** The data of yield, quality and other parameters are presented in Tables 2.1 to 2.15. The perusal of data indicated that the genotype SU 1175 ranked first for green (431.1 q/ha) as well as dry fodder (176.6 q/ha) yields on all India basis. The check HC 308 had taken second position for both green (426.7 q/ha) and dry (166.0 q/ha) fodder yields. Third position for green fodder yield was occupied by UTFS 51 (416.2 q/ha) and for dry fodder yield the third position was taken by SU 1227 (161.2 q/ha). In Zone I, none of the genotypes could out yield the check HC 308 (425.4 q/ha) for green fodder yield, however only SU 1175 (150 q/ha) could out yield the HC 308 (149.2 q/ha) for dry fodder yield in this zone. SU 1175 was standing first for green (466.7 q/ha) and dry (265.2 q/ha) fodder yields in zone II also. For green and dry fodder yields per day also SU 1175 was the best genotype (5.68 q/ha and 2.26 q/ha). For green and dry fodder yields per day, it was followed by the check, HC 308 (5.42 q/ha and 2.04 q/ha) and UTFS 51 (5.38 q/ha and 2.02q/ha). For both shoot fly and stem borer, S 540 was the best genotype (15.9% shoot fly deadhearts (SFDH) and 13.8% stem borer deadhearts (SBDH), followed by HC 308 (16.7% SFDH and 14.9% SBDH). For zonate leaf spot, all the genotypes

tested are on par with the check, HC 308. For anthracnose, the genotypes, UTFS 51 (2.0) and SU 1175 (2.33) were significantly superior to the check, HC 308 (3.00). The performance of better genotypes is depicted below:

**Table 3. Performance of promising single cut sorghum genotypes in initial trial during 2007-08 (Entries- 4; Checks- 2; Locations:13)**

All India Average

Entry	Yield						Quality				Insect pests DH (%)		Diseases (score)								
	GFY (q/ha)		DFY (q/ha)		GFY/day (q/ha)		DFY/day (q/ha)		PY (q/ha)		DDM (q/ha)		SF	SB	ZLS	ALS	GLS	SS			
	R	% +/-	R	% +/-	R	% +/-	R	% +/-	R	% +/-	R	% +/-									
SU 1175	431.1	1	1.03	176.6	1	6.38	5.68	1	2.26	4	7.7	4	48.0	5	31.3	19.2	2.56	2.33	1.00	3.00	
UTFS 51	416.2	3	-2.46	161.1	4	-2.95	5.38	3	2.02	5	7.5	5	50.4	4	22.0	25.6	2.67	2.00	1.00	3.00	
SU 1227	397.3	4	-6.89	161.2	3	-2.89	4.96	4	1.96	3	8.1	3	46.9	6	33.4	24.8	2.33	2.83	1.00	2.00	
Best check																					
HC 308	426.7	2		166.0	2		5.42	2	2.04	1	9.7	1	61.5	1	16.7	14.9	3.00	3.00	1.00	2.00	
CD (5%)	61.7			20.4			0.93		0.3		4.8		29.4		19.1	3.4	0.43	0.43	0.00	0.00	
CD (1%)	83.8			27.6			1.28		0.45		6.8		41.8		29.9	4.8	0.61	0.61	0.01	0.01	
C.V. (%)	17.35			16.61			18.23		20.71		31.8		30.4		25.91	5.33	7.57	7.57	0.24	0.09	

GFY- Green fodder yield, DFY- Dry fodder yield, PY- Protein yield; DDM- Digestible dry matter, DH- deadhearts, SF- Shoot fly, SB- Stem borer, ZLS- Zonate leaf spot, ALS- Anthracnose leaf spot, GLS- Grey leaf spot, SS- Sooty stripe

**Quality:** Four genotypes and two checks, HC 308 and CSV 15 were tested for quality parameters (Tables 2.16 to 2.17). The HCN content in Table 2.17, showed variation in the range of 110.1 to 146.8 ppm on average. TSS varied from 7.1 to 10.92%. The genotype UTFS 51 showed the highest TSS content. The protein content varied from 7 to 8.17 percent on all India basis. Highest protein percentage was noticed in CSV 15 (8.17%) followed by UTFS 51 (8.13%) and HC 308 (7.88%). The average protein yield was highest in HC 308 (9.7q/ha) followed by CSV 15 (9.3q/ha) and SU 1227 (8.7q/ha). The IVDMD varied from 45.9% (S 540) to 48.8% (UTFS 51). For IVDMD, UTFS 51 was followed by SU 1175 (48.6%) and SU 1227 (47.3%). The DDM values varied from 46.9% (SU 1227) to 61.5 q/ha (HC 308). Considering the quality traits together, none of the genotypes could surpass the checks for protein yield and DDM values. But for IVDMD and TSS, UTFS 51 was ranking first. It is ranking second in protein percent.

**All India Co-ordinated Multicut trials on forage sorghum:** These trials were sent to 16 locations but were conducted at 13 locations. Urulikanchan and Izatnagar did not conduct the trials.

### Trial 3: Advanced Hybrid/ varietal trail (Multi-cut)

**Breeding:** Four hybrids and two varieties were tested in this trial against two checks viz., CSH 20MF (hybrid) and SSG 59-3 (variety). The data on yield, quality and other traits are presented in Tables 3.1 to 3.24. The hybrid UTMCH 1302 (794.7 q/ha) ranked first for green fodder yield followed by the check, CSH 20MF (793.2 q/ha). The hybrid GK 909 (772.1 q/ha) occupied third place for green fodder yield. In Zone I also the same lines performed in the same order for green fodder yield. In Zone II, none of the hybrids could out yield the check, CSH 20M F for green fodder yield. For dry fodder yield, the check CSH 20MF (219.2 q/ha) was the highest yielder followed by UTMCH 1302 (216.7 q/ha) and UTMCH 1304 (211.8 q/ha). In Zone I also, CSH 20MF (244.7 q/ha) was the highest yielder followed by UTMCH 1302 (238.5 q/ha) and GK 909 (233.5 q/ha). In Zone II, UTMCH 1304 was the highest yielder (184.6 q/ha) followed by UTMCH 1302 (181.9 q/ha). For green and dry fodder yields per day, CSH 20MF ranked first (6.31 q/ha of GFY and 1.46 q/ha of DFY per day) followed by UTMCH 1302 (6.29 q/ha and 1.42 q/ha). UTMCH 1304 (6.13 q/ha) occupied the third position for GFY per day, while for DFY, GK 938 (1.38 q/ha) was in 3<sup>rd</sup> position. Considering the yield components, UTMCH 1302 was the best hybrid followed by UTMCH 1304 and GK 909. Although two varieties were tested in this trial, yet none of them could compete with the check SSG 59-3 for green and dry fodder yields at India level. But in Zone II, UTMCH 534 recorded higher green and dry fodder yields along with more green and dry fodder yields per day compared to the check, SSG 59-3

With regard to shoot fly tolerance, all the hybrids showed less deadheart percentage compared to the check, CSH 20MF (12.5% DH), the lowest incidence being in UTMCH 1302 (10.7% DH). Both the varieties also showed less incidence of shoot fly compared to the check, SSG 59-3 (12.2% DH). Similarly, for stem borer also, all the hybrids recorded less incidence compared to the hybrid check, CSH 20MF (19.4% DH). For zonate leaf spot and grey leaf spot, the incidence was high in GK 909 and GK 938. All other genotypes were on par. For anthracnose and sooty stripe, all the genotypes were on par with each other. The promising genotypes of advanced trial (multicut) are given in the table below.

**Table 4. Performance of promising multi-cut sorghum genotypes in advanced trial during 2007-08 (Entries- 4 hybrids and 2 varieties; Checks- 2; Locations: 13)**

All India Average																				
Yield						Quality						Insect pests DH (%)		Diseases (score)						
Entry	GFY (q/ha)			DFY (q/ha)			GFY/day (q/ha)		DFY/day (q/ha)		PY (q/ha)		DDM (q/ha)		SF	SB	ZLS	ALS	GLS	SS
	R	% +/-		R	% +/-		R		R		R		R							
UTMCH 1302	794.7	1	0.19	216.7	2	-1.14	6.29	2	1.40	2	15.5	1	105.2	1	10.7	14.9	2.13	1.78	1.00	3.00
UTMCH 1304	763.8	4	-3.71	211.8	3	-3.37	6.13	3	1.35	5	14.4	2	93.5	2	15.3	18.4	2.59	1.89	1.00	3.00
GK 909	772.1	3	-2.67	209.4	4	-4.47	6.11	4	1.37	4	12.8	6	82.1	5	11.7	15.2	2.83	2.00	4.00	1.00
Best check																				
CSH20MF	793.2	2		219.2	1		6.31	1	1.46	1	14.1	3	93.1	3	12.5	19.4	2.08	2.00	1.00	3.00
CD (5%)	59.1			20.3			0.78		0.24		3.9		23.6		2.2	7.3	0.72	0.43	0.00	0.00
CD (1%)	78.4			27.0			1.05		0.32		5.41		32.8		2.9	10.1	0.98	0.60	0.00	0.00
CV (%)	10.34			12.94			13.23		16.88		15.7		15.8		15.1	26.4	20.0	12.8	0.09	0.10

GFY- Green fodder yield, DFY- Dry fodder yield, PY - Protein yield; DDM- Digestible dry matter, DH- deadhearts, SF- Shoot fly, SB- Stem borer, ZLS - Zonate leaf spot, ALS- Anthracnose leaf spot, GLS- Grey leaf spot, SS- Sooty stripe

The performance of promising genotypes tested in All India Co-ordinated trials during last three years is presented in the following table:

**Table 5: Performance of promising genotypes tested in All India Co-ordinated Multicut trials during the last three years**

Entry	Year	Yield						Quality				Insect pests DH (%)		Diseases (score)					
		GFY (q/ha)		DFY (q/ha)		GFY/day (q/ha)		DFY/day (q/ha)		Protein yield (q/ha)		DDM (q/ha)		SF	SB	ZLS	ALS	GLS	SS
		R		R		R		R		R		R							
UTMCH 1302	2004*	906.6	2	219.2	2	6.78	2	1.58	1	7.6	1	176.4	1	17	26	1.7		1.8	1.7
	2005	647.0	4	164.2	3	4.75	4	1.01	3	9	3	110.3	1	32	48	2.2	1.7	1.8	3.0
	2006	805.2	2	193.3	1	6.58	1	1.54	1	16.5	3	105.7	1	21	16	2.3	1.9	1.0	3.0
	2007	794.7	1	216.7	2	6.29	2	1.40	2	15.49	1	105.2	1	10.7	14.9	2.13	1.78	1.00	3.00
	<b>Av</b>	<b>788.4</b>		<b>198.3</b>		<b>6.1</b>		<b>1.38</b>		<b>12.15</b>		<b>124.4</b>		<b>20.2</b>	<b>26.2</b>	<b>2.08</b>	<b>1.79</b>	<b>1.4</b>	<b>2.67</b>
UTMCH 1304	2006*	691.29	6	184.1	3	6.38	3	1.45	3	19.94	3	102.4	3	22.9	14.1	2.0	1.7	1.0	3.0
	2007	763.8	4	211.8	3	6.13	3	1.35	5	14.41	2	93.5	2	15.3	18.4	2.59	1.89	1.00	3.00
	<b>Av</b>	<b>727.5</b>		<b>197.9</b>		<b>6.25</b>		<b>1.4</b>		<b>17.17</b>		<b>97.9</b>		<b>19.1</b>	<b>16.2</b>	<b>2.29</b>	<b>1.79</b>	<b>1.00</b>	<b>3.00</b>
GK 909	2006*	878.35	1	208.3	1	6.84	1	1.62	1	22.67	1	109.4	1	25.4	33.9	2.8	1.8	2.5	1.0
	2007	772.1	3	209.4	4	6.11	4	1.37	4	12.8	6	82.1	5	11.7	15.2	2.83	2.00	4.00	1.00
	<b>Av</b>	<b>825.2</b>		<b>208.8</b>		<b>6.47</b>		<b>1.49</b>		<b>17.73</b>		<b>95.7</b>		<b>18.5</b>	<b>24.5</b>	<b>2.81</b>	<b>1.9</b>	<b>3.25</b>	<b>1.00</b>
UTMC 534	2006*	648.39	8	144.6	8	5.06	8	1.14	8	14.48	7	76.83	7	22.1	36.4	2.2	1.8	1.0	3.0
	2007	665.6	7	179.3	8	4.93	8	1.07	8	11.85	8	90.6	4	11.1	12.8	2.13	1.89	1.00	3.00
	<b>Av</b>	<b>657.0</b>		<b>161.9</b>		<b>4.99</b>		<b>1.10</b>		<b>13.16</b>		<b>83.7</b>		<b>16.6</b>	<b>24.6</b>	<b>2.16</b>	<b>1.84</b>	<b>1.00</b>	<b>3.00</b>
Best check																			
SSG 59-3	2005	627.0	5	144.9	7	4.68	5	0.97	5	9.5	2	82.1	4	24	33	2.8	2.9	4.0	1.7
	2006	679.3	7	153.0	8	5.49	7	1.18	8	14.2	7	75.5	8	19	10	3.0	2.3	2.5	1.0
	2007	685.1	6	191.0	6	5.36	6	1.18	6	12.54	7	72.7	7	12.2	13.9	2.49	2.11	4.00	1.00
	<b>Av.</b>	<b>663.7</b>		<b>163.0</b>		<b>5.18</b>		<b>1.11</b>		<b>12.08</b>		<b>76.77</b>		<b>18.4</b>	<b>19.0</b>	<b>2.76</b>	<b>2.47</b>	<b>3.5</b>	<b>1.23</b>
CSH 20MF	2005	717.6	1	164.8	2	4.96	3	1.03	2	8.8	6	90.1	3	43	42	2.1	1.9	2.5	2.8
	2006	720.9	4	169.1	4	5.91	3	1.33	3	16.6	2	93.5	3	25	16	2.1	1.7	1.0	3.0
	2007	793.2	2	219.2	1	6.31	1	1.46	1	14.07	3	93.1	3	12.5	19.4	2.08	2.00	1.00	3.00
	<b>Av</b>	<b>743.9</b>		<b>184.4</b>		<b>5.73</b>		<b>1.27</b>		<b>13.16</b>		<b>92.2</b>		<b>26.8</b>	<b>25.8</b>	<b>2.09</b>	<b>1.87</b>	<b>1.5</b>	<b>2.93</b>

\*-Data of initial trial

**Quality:** Six genotypes were evaluated for quality parameters against two standard checks SSG 59-3 and CSH 20MF at 6 locations. At Hisar and Ludhiana two cuts were taken, while at Delhi, Coimbatore, Rauri and Pantnagar one cut was taken. Results are represented in tables 3.25 to 3.33. The average HCN content varied from 103.2 ppm (UTMCH 1302) to 153.6 ppm (UTMCH 1304). The average protein content of the two cuts ranged from 7.55% (CSH 20MF) to 8.96% (JHV 14). The second and third positions for protein percent were occupied by GK 909 (8.39%) and UTMCH 1302 (8.29%). All the four hybrids and two varieties showed higher protein percentage compared to their respective checks. Similarly, the average protein yield was highest in the genotype, UTMCH 1302, followed by UTMCH 1304 and CSH 20MF. Among the varieties, JHV 14 showed highest protein yield followed by the check, SSG 59-3. The average IVDMD percentage of two cuts on all India basis ranged from 43.77% (GK 938) to 49.9% (UTMCH 1304). The second best



hybrid for IVDMD percent was UTMCH 1302 (45.4%). Among the varieties, UTMCH 534 (46.43%) was the best, followed by the check, SSG 59-3 (45.4%). The total DDM values over two cuts ranged from 68.8q/ha (GK 938) to 105.2 q/ha (UTMCH 1302). UTMCH 1304 (93.5 q/ha) was the second best hybrid followed by the check, CSH 20MF (93.1 q/ha). Among the varieties, UTMCH 534 (90.6 q/ha) was the best for DDM value followed by the check, SSG 59-3 (72.7 q/ha). Considering the quality characters, UTMCH 1302 followed by UTMCH 1304 among the hybrids, and UTMCH 534 among the varieties were the best.

#### Trial 4: Initial Hybrid/ Varietal Trial (Multi-cut)

**Breeding:** Six genotypes (4 hybrids and 2 varieties) were tested in this trial against two checks, viz, SSG 59-3 (variety) and CSH 20MF (hybrid). The data of yield and other attributes are presented in tables 4.1 to 4.23. The hybrid, UTMCH 1305 (711.1 q/ha GFY and 182.8 q/ha DFY) out yielded the check, CSH 20MF (665.1 q/ha GFY and 176.5 q/ha DFY) for both green and dry fodder yields. GK 917 occupied the third position for green (628 q/ha) and dry (163.8 q/ha) fodder yields. UTMCH 1305 ranked first for green fodder yield per day (6.61 q/ha) and dry fodder yield per day (1.67 q/ha) also, followed by CSH 20MF (6.23 q/ha GFY and 1.62 q/ha DFY per day), and GK 917 (5.94 q/ha GFY and 1.52 q/ha DFY per day). In zone I, the same genotypes performed better for green and dry fodder yields. But in Zone II, ARFSH 559 (597.9 q/ha) ranked first for green fodder yield followed by the check, CSH 20MF (585.6 q/ha). For dry fodder yield none of the hybrids out yielded the check, CSH 20MF (133.7 q/ha). For green and dry fodder yields per day also ARFSH 559 (7.34 q/ha GF and 1.55 q/ha DFY) topped in Zone II followed by the check, CSH 20MF (7.08 q/ha GFY and 1.46 q/ha DFY). None of the varieties were found to out yield the check, SSG 59-3 either for green or dry fodder yields.

For shoot fly, SSG 59-3 was the best genotype (14.7% DH). Among the hybrids, UTMCH 1305 (15.6% DH) recorded significantly low level of shoot fly incidence over the check hybrid, CSH 20MF (18.6% DH). All other hybrids are on par with the check. None of the varieties were better than SSG 59-3. For stem borer, HH 386 (14.3 DH) was the best followed by SSG 59-3 (15.7% DH). The hybrid, UTMCH 1305 was found to have multiple resistance for foliar diseases. The following table shows the performance of better genotypes in this trial.

**Table 6. Performance of promising multi-cut sorghum genotypes in initial trial during 2007-08 (Entries- 4 hybrids and 2 varieties; Checks- 2; Locations: 11)**

Entry	All India Average																			
	Yield						Quality				Insect pests DH (%)		Diseases (score)							
	GFY (q/ha)		DFY (q/ha)		GFY/day (q/ha)	DFY/day (q/ha)	PY (q/ha)		DDM (q/ha)		SF	SB	ZLS	ALS	SS					
UTMCH1305	711.1	1	6.92	182.8	1	3.57	6.61	1	1.67	1	17.9	1	127.4	1	15.6	22.4	2.08	1.78	2.00	
GK917	628.0	3	-5.58	163.8	3	-7.19	5.94	3	1.67	1	14.1	3	99.9	3	17.9	19.9	2.42	1.78	1.00	
Best check																				
CSH20MF	665.1	2		176.5	2		6.23	2	1.62	2	15.6	2	115.1	2	18.6	24.0	2.25	2.00	3.00	
CD (5%)	72.6			24.7			0.72		0.24		3.99		32.7		2.6	13.5	0.74	0.45	0.00	
CD (1%)	96.6			32.8			0.95		0.32		5.44		45.3		3.2	19.9	1.01	0.62	0.00	
CV (%)	13.7			18.18			13.5		18.41		19.1		19.2		4.56	27.4	21.8	12.6	0.1	

GFY- Green fodder yield, DFY- Dry fodder yield, PY- Protein yield; DDM - Digesible dry matter, DH- deadhearts, SF- Shoot fly, SB- Stem borer, ZLS - Zonate leaf spot, ALS - Anthracnose leaf spot, GLS- Grey leaf spot, SS- Sooty stripe

**Quality:** The analysis of quality traits in six genotypes along with two checks, SSG 59-3 and CSH 20MF showed that the HCN content varied from 81.5 ppm (UTMC 535) to 124.8 ppm (PC 901), indicating that the genotypes were free from lethal dose of HCN (200 ppm). The average protein content varied from 6.86% (HH 386) to 8.96% (ARFSH 559). ARFSH 559 was followed by UTMCH 1305 (8.81%). The protein yield ranged from 11.05 q/ha (HH 386) to 17.92 q/ha (UTMCH 1305). The average IVDMD value ranged from 43.3% (CSH 20MF) to 48.2% (HH 386). HH 386 was followed by ARFSH 559 (45.2%) and UTMCH 535 (45.2%) for IVDMD content. For DDM value, UTMCH 1305 was the best genotype (127.4 q/ha) followed by the check, CSH 20MF (115.1 q/ha) and GK 917 (99.9 q/ha). UTMCH 1305 and ARFSH 559 were found to be good genotypes as far as quality parameters are concerned.

#### Other trials

##### Trial 5: Advanced seed yield trial (Hisar, Pantnagar, Delhi, Ludhiana)

The seed of this trial was sent to 6 locations. Data of this trial were not received from Akola. All the entries of Advance Varietal Trial (single cut) were tested in this trial along with one multicut entry i.e. UTMCH 534. Eight genotypes were tested against two checks, HC 308 and CSV 15. The data on seed yield, stover yield and days to maturity are presented in Tables 5.1 to 5.2. The data revealed that the check, CSV 15 ranked at the top in seed yield (11.6 q/ha) followed by PC 1002 (10.4 q/ha) and UTFS 49 (10.2 q/ha). The genotype CSV 15 took minimum days to maturity (111days) followed by UTFS 49, SRF 305, SU 1211 and S 541 which took 117 days to mature. The genotype SRF 305 gave maximum dry fodder yield (234.9 q/ha) followed by HC 308 (231.7 q/ha) and PC 1003 (215 q/ha).

## Forage agronomy and quality

### Trial 6: Response of single cut forage sorghum genotypes to different N levels (Hisar, Udaipur, Pantnagar)

The experiment was carried out with the objective of finding out the optimum dose of nitrogen for newly developed varieties to obtain their maximum yield potential. The experiment was conducted at 5 locations, viz., Hisar, Pantnagar, Udaipur, Dharwad and Ludhiana. The trial failed at Ludhiana, and Dharwad used different nitrogen levels, viz. 0, 50, 75 and 100kg N/ha. Therefore, the trial was conducted at Hissar, Pantnagar and Udaipur. The treatments included were the single cut cultivars (S 540, S 541 & HC 308) and three levels of nitrogen rates (80 to 120 kg with 20kg increments). The anova in Table 7 a & b indicates that there was no significant interaction between cultivar and fertilizer input across all the observations. The nitrogen variability influenced the dry fodder production and the associated characters like tillers & green leaves per hill (plant) as well the stem girth. Since there was no significance difference among the genotypes in terms of green and dry fodder yields the associated characters are not discussed despite being statistically significant.

**Table 7 Anova of multi-location means of observed characters.**

(a)

	Dry Fodder (q ha <sup>-1</sup> )	Green Fodder (q ha <sup>-1</sup> )	Protein (q ha <sup>-1</sup> )
<i>Main effects</i>			
Genotype (G)	NS	NS	NA
Nitrogen rate (N)	*	NS	NA
<i>Interaction effect</i>			
Gx N	NS	NS	NA

(b)

	Tillers (no. hill <sup>-1</sup> )	Stem girth (cm)	Green leaves (no. hill <sup>-1</sup> )
<i>Main effects</i>			
Genotype (G)	*	*	*
Nitrogen rate (N)	*	*	*
<i>Interaction effect</i>			
Gx N	NS	NS	NS

NS – Not significant, NA – Statistically not analyzed, \* - Significant at 1%

The dry fodder yield across nitrogen rates increased with increasing rate of nitrogen application. Comparison of yields across nitrogen rates indicated that the application rates of 100 (152 q ha<sup>-1</sup>) and 120 (171 q ha<sup>-1</sup>) were significantly higher than 80 kg N ha<sup>-1</sup> (128 q ha<sup>-1</sup>).

**Quality (Hisar):** There was increase in protein and DDM yield with increase in nitrogen application, which ranged from 4.52 to 6.06% and 56.78 to 77.72 q/ha respectively. The variety, S 541 ranked first in protein (9.29 q/ha) and DDM yields (75.36 q/ha) (Table 6.1). Similarly the protein yield with the highest rate of nitrogen (N) application was 12 q ha<sup>-1</sup> indicating that direct link between protein and N.

### Trial 7: Effect of INM on yield and quality of single cut forage sorghum (Hisar, Udaipur, Pantnagar, Ludhiana)

A multi-location trial to study the influence of inorganic and organic source of nutrients on quantity and quality of forage sorghum was conducted at Hissar, Pantnagar and Udaipur. There were 8 treatment combinations of organic and inorganic source of nutrients. Four of the 8 treatments included 100 % recommended dose of fertilizer (RDF) and + 3 levels of zinc sulphate (15, 20, 25 kg ha<sup>-1</sup>). The other four treatments included 2 each of 75% & 50% of RDF plus 25% & 50% N from Farm yard manure (FYM) or Vermicompost. The ninth treatment was a check treatment of no application of external inputs (control).

**Table 8. Influence of external inputs (+ or – organic/ inorganic) on forage sorghum**

Treatment	Green fodder (q ha <sup>-1</sup> )	Dry fodder (q ha <sup>-1</sup> )	Protein yield (q ha <sup>-1</sup> )
Control (no inputs)	357	84	4.2
RDF (100%)	582	150	9.2
RDF (100%) plus 15 kg ZnSO <sub>4</sub> ha <sup>-1</sup>	595	163	7.7
RDF (100%) plus 20 kg ZnSO <sub>4</sub> ha <sup>-1</sup>	606	165	9.3
RDF (100%) plus 25 kg ZnSO <sub>4</sub> ha <sup>-1</sup>	621	167	9.3
RDF (75%) plus 25% N from FYM	583	141	7.3
RDF (75%) plus 25% N vermicompost	570	148	8.7
RDF (50%) plus 50% N from FYM	563	137	5.8
RDF (50%) plus 50% N vermicompost	550	140	7.9
CD (5%)	103	29	0.02

The statistical analysis indicated that all combinations of external inputs whether from organic or inorganic source had significant influence on quantity and quality observations. The highest green and dry fodder yields of 621 & 167 q ha<sup>-1</sup> respectively were attained with application of 100% RDF and 25 kg Zinc Sulphate (Table 8). At Ludhiana, the treatment 100% RDF + 20kg zinc sulphate per hectare had given highest yield, followed by 100% RDF and 25kg zinc sulphate per hectare (Table 7.3).

**Quality (Hisar):** Similarly in terms of quality parameters analysed at Hisar the protein yield of 9.3 q ha<sup>-1</sup> was attained with application of 100% RDF and 25 kg Zinc Sulphate. The protein percentage is higher (6.35%) when the recommended dose of fertiliser is partly replaced by vermicompost (Table 7.2).

#### **Trial 8: Intercropping studies on single cut forage sorghum (Pantnagar)**

A single-location trial to study the output and economics of including intercrops in single cut forage sorghum was conducted at Hisar. There were 9 treatment combinations in all. Three of the 9 treatments included the sole crops of forage sorghum, pillipesara and cowpea. The other six treatments were forage sorghum with two intercrop of pillipesara and cowpea in 3 different row proportions of 1:1, 2:1 & 2:2

**Table 9. Influence of external inputs (+ or – organic / inorganic / biofertilizer) on forage sorghum**

Treatment	Green fodder (q ha <sup>-1</sup> )	Dry fodder (q ha <sup>-1</sup> )	Gross returns (Rs. ha <sup>-1</sup> )
Sole sorghum	580	188	26156
Sole pillipesara	254	67	11605
Sole cowpea	342	99	15443
Sorghum + Pillipesara 1:1	663	174	29816
2:1	607	169	27316
2:2	633	196	28477
Sorghum + Cowpea 1:1	657	193	29548
2:1	579	184	26066
2:2	526	162	23656
CD (5%)	219	35	5251

The results analysed in Table 9 indicate that both the intercrops had given an additional bonus of green fodder yield as compared to sole forage sorghum (580 q ha<sup>-1</sup>). In both the intercropping systems i.e., Sorghum + Pillipesara and Sorghum + Cowpea the row proportion of 1:1 gave higher green fodder yield which was reflected in the gross returns of Rs.29816 & 29,548 respectively. The cost-benefit analysis indicated that sorghum and pillipesara in 1:1 ratio was most profitable with a cost-benefit ratio of 2.36 followed by sorghum and pillipesara in 2:2 ratio (cost-benefit ratio of 2.22).

#### **Trial 9: Response of multicut Forage Sorghum hybrids/varieties under different nitrogen levels(Hisar, Udaipur, Pantnagar, Ludhiana)**

The experiment was conducted to find out the optimum requirement of nitrogen for multicut forage sorghum hybrids/varieties. The multi-location trial was conducted at Hissar, Pantnagar, Udaipur and Ludhiana. The treatments included were the multi-cut cultivars (UTMCH 1302, UTMCH 532, SSG 593, CSH 20MF) and four levels of nitrogen rates (0 to 150 kg with 50kg increments). The anova in Table 9 a & b indicates that there was no significant interaction between cultivar and fertilizer input across all the observations. There were no significance differences among the genotypes in terms of both green and dry fodder yields. The nitrogen variability influenced the green and dry fodder production along with the associated characters like tillers & green leaves per hill (plant).

Green fodder yield from all the three cuts was found to be significantly higher with 150 kg N ha<sup>-1</sup> application as compared to all other levels. The increase in input with every 50 kg level N over control was 33, 47 and 63%, which indicated that investment in fertilizer nitrogen is directly related to the green forage output.

Similarly comparison of green (588, 773, 863, 959 q ha<sup>-1</sup>) and dry fodder yields (133, 181, 204, 229 q ha<sup>-1</sup>) across the four nitrogen levels (Fig 2) indicated a constant 75% content of moisture level which was not influenced by the nutrient input.

**Quality (Hisar):** The average protein and IVDMD percentage of two cuts varied from 6.0 to 7.78% and 38.2 to 42.9%, respectively. The total protein yield ranged from 3.86 to 10.16q/ha and DDM from 23.7 to 52.5 q/ha. The protein and all the other quality parameters decreased in second cut as compared to that of first cut. With regard to nitrogen levels, total protein and DDM yield increased considerably from 3.86 to 10.16 q/ha and 23.72 to 52.5 q/ha with an increase in nitrogen levels from 0 to 150 q/ha.

**Table 10. Anova of multi-location means of observed characters.**

(a)

	Dry Fodder (3 cuts total) (q ha <sup>-1</sup> )	Green Fodder (3 cuts total) (q ha <sup>-1</sup> )
<i>Main effects</i>		
Genotype (G)	NS	NS
Nitrogen rate (N)	*	*
<i>Interaction effect</i>		
Gx N	NS	NS

(b)

	Tillers (no. hill <sup>-1</sup> )	Green leaves (no. hill <sup>-1</sup> )
<i>Main effects</i>		
Genotype (G)	NS	*
Nitrogen rate (N)	*	*
<i>Interaction effect</i>		
Gx N	NS	NS

NS – Not significant, \* - Significant at 1%

**Trial 10: Integrated nutrient management studies in forage sorghum based cropping system (Hisar, Pantnagar)**

The experiment was taken up with the objective of finding out the optimum combination of organic, inorganic and biofertilizers in forage sorghum based cropping system. A multi-location trial to study the influence of organic/inorganic source of nutrients and bio-fertilizer on quantity and quality of forage sorghum was conducted at Hisar and Pantnagar. There were 8 treatment combinations in all.

- Three of the 8 treatments included the control without any inputs, 100% N through FYM & 100% RDF through inorganic source.
- Two of the treatments were proportions of inorganic plus organic i.e., 75% RDF + 25% N through FYM, 50% RDF + 50% N through FYM.
- The other three treatments included 50% RDF + Azospirillum, 75% of RDF + Azospirillum, and 50% RDF + 25% N through FYM + Azospirillum.

**Table 11. ANOVA of multi-location means of observed characters.**

(a) Mean of 2 locations

	Dry Fodder (q ha <sup>-1</sup> )	Green Fodder (q ha <sup>-1</sup> )	Plant height at 1 <sup>st</sup> cut (cm)
<i>Treatments</i>			
Organic+/- inorganic +/- biofertilizer	*	NS	NS

(b) Mean of Hissar location

	Protein yield (q ha <sup>-1</sup> )	DDM (q ha <sup>-1</sup> )	IVDMD (%)
<i>Treatments</i>			
Organic+/- inorganic +/- biofertilizer	*	*	*

NS – Not significant, \* - Significant at 1%

**Table 12. Influence of external inputs (+ or – organic / inorganic / biofertilizer) on forage sorghum**

Treatment	Green fodder (q ha <sup>-1</sup> )	Dry fodder (q ha <sup>-1</sup> )	Protein yield (q ha <sup>-1</sup> )
Control (no inputs)	407	94	8
RDF (100%)	741	169	12
FYM (100%)	580	133	11
RDF (75%) plus 25% N from FYM	758	181	14
RDF (50%) plus 50% N from FYM	694	167	11
RDF (50%) plus Azospirillum (A)	636	143	11
RDF (75%) plus Azospirillum (A)	773	168	13
RDF (50%) plus 25% N from FYM +A	717	161	12
CD (5%)	NS	37	0.01

Results in Table 12 indicate that the lowest green and dry fodder as well as the protein yield were recorded in the control treatment. The next lowest observations (green & dry fodder, protein yield) were from the organic source of farm yard manure (FYM). Biofertilizer treatment too showed a variable response of different observations in combination with or without FYM. The highest total green fodder over locations was obtained from the treatment 75% RDF + Azospirillum and total highest dry fodder was obtained from the treatment, 75% RDF + 25%N through FYM.

Since organic source has long term implications, the results from few years may be more meaningful rather than one year. For short term gains, inorganic treatment of recommended dose of fertilizer (100% RDF) could be the best alternative, but for long term sustenance of soil health a combination of both organic and inorganic sources of fertilizer could be recommended.

**Quality (Hisar):** The protein percentage and IVDMD percentage was found to be highest in the treatment 75% RDF + Azospirillum. The total protein yield and DDM were highest in 75% RDF + 25% N through FYM. Protein content and yield decreased in second cut as compared to that of first cut in all the treatments (Table 10.3).

## Animal nutrition

### Trial 11: Nutritional evaluation of single cut forage sorghum genotypes SRF 305, UTFS 49 against check variety HC 308 in cross bred calves (Hisar)

The sorghum fodder of two varieties HC-308 and UTFS-49 were grown at Farm under Forage Section, CCSHAU, Hisar. The fodder from both varieties for feeding trial was taken after 70 days of sowing. Ten crossbred female calves of average body weight  $90.5 \pm 6.73$  kg and of average age of  $5 \pm 0.3$  months were allotted randomly to two groups. The animals were kept in well ventilated disinfected stalls provided with individual feeder. The calves of G-I and G-II were fed solely on chaffed sorghum fodder from the varieties HC-308 and UTFS-49, respectively. The animals were supplemented with 25g mineral mixture per day per animal and drinking water was made available all the time. A feeding trial comprising of 25 days as preliminary period and 7 days digestion trial was conducted. Feed and faecal samples were analyzed for proximate principles and cell wall fractions. The chemical constituents of two varieties of sorghum showed that average content of crude protein was higher in HC-308 as compared to UTFS-49 and crude fibre, NDF, ADF, Cellulose and lignin contents were higher in UTFS-49.

**Table 13. Proximate principles and fibre fraction of different sorghum varieties**

Parameters	Variety	
	HC-308	UTFS-49
Dry matter	25.48	27.43
Organic matter	93.87	92.36
Crude protein	6.89	6.23
Crude fibre	27.37	29.98
Ether extract	1.83	1.90
NFE	57.41	54.46
Ash	6.59	7.43
Neutral Detergent Fire	63.45	67.78
Acid Detergent Fire	45.93	48.83
Hemicellulose	17.52	18.95
Cellulose	32.48	34.84
Lignin	6.13	7.33

The dry matter intake and nutrients intake, digestibility of nutrients and nutritive values of two varieties are presented in table 14. The mean values of dry matter intake per day and per 100 kg body weight of calves did not differ significantly due to feeding of fodder from either of the variety. The mean values of crude protein intake per day were significantly ( $P < 0.05$ ) higher in calf groups fed with fodder of HC-308 (156.40g) as compared to group fed with UTFS-49 fodder (137.06g). Similarly digestible crude protein and total digestible nutrient intake were significantly ( $P < 0.05$ ) higher by feeding HC-308 fodder as compared to UTFS-49. The nutritive value in terms of DCP and TDN percent were also significantly ( $P < 0.05$ ) more in HC-308 in comparison to UTFS-49. The mean values of crude protein, crude fibre, nitrogen free extract, neutral detergent fibre, acid detergent fibre and cellulose digestibility were significantly ( $P < 0.05$ ) higher in cross bred calves fed with sorghum fodder of HC-308 as compared to UTFS-49 fodder. This might be due to higher content of CF, NDF, ADF, cellulose and lignin in UTFS-49 than HC-308 variety fodder. However, dry matter, ether extract and NFE digestibility did not differ significantly due to feeding of fodder from either of the variety. It was concluded from the present study that sorghum fodder from variety HC-308 was nutritionally better than variety UTFS-49 in terms of nutrients intake, nutrients utilization, nutritive value and total digestible nutrients.

**Table 14. Nutrients intake, nutrients digestibility and nutritive value of different variety of sorghum fodder fed to calves.**

Attributes	Variety	
	HC-308	UTFS49
Body weight (kg)	102.78±3.87	98.41±2.47
Dry matter intake (kg)	2.27±0.13	2.20±0.20
DMI/100kg B.wt.(kg)	2.20±0.11	2.21±0.19
CP intake (g)	156.40±9.46	137.06±8.88
DCP intake (g)	81.91±3.45	66.93±3.21
TDN intake (kg)	1.27±0.011	1.2416± 0.013
Digestibility% (DM basis)		
Dry matter	58.78±2.32	56.89±2.43
Crude Protein	52.37±1.20	48.83±1.11
Ether Extract	40.37±2.40	39.48±1.48
Crude fibre	50.68±1.02	47.32±2.22
Nitrogen Free extract	63.57±1.45	62.00±2.01
Neutral Detergent Fibre	51.43±1.41	49.83±0.95
Acid Detergent Fibre	41.58±2.01	38.74±1.81
Hemi cellulose	53.31±0.20	52.40±1.03
Cellulose	48.50±1.10	46.38±1.00
Nutritive Value		
DCP%	3.61±0.02	3.04±0.08
TDN%	55.94±1.20	52.72±1.31

**Trial 12: Chemical composition, in vitro and in sacco studies of multicut forage sorghum strains at different cuts (Hisar)**

Various sorghum (*Sorghum bicolor*) fodder strains were chemically analysed against the check variety SSG 59-3 (Six replications). Fodder samples of ninety three (93) sorghum strains and six samples of check variety SSG 59-3 after 70 days of sowing were collected from the experimental field of Forage Section, CCSHAU, Hisar and were chemically analysed for various nutritional parameters by using methods of (AOAC,1995) and (Goering and Vanmssoest, 1970) are presented in Table 15. The dry matter content in sorghum strains ranged from 19.37 to 27 percent. Variation in CP, Neutral Detergent Fiber, Acid Detergent Fiber and Cellulose were observed which might be due to the genetical make up since they were grown under similar environmental condition and all recommended cultural practices were applied to raise a healthy crop. Forage with high concentration of crude protein are considered high quality, because if high-protein forage is fed, less supplemental protein will be needed and CP content is positively correlated to energy content of forage. In contrast, fiber content of forage is inversely related to quality, forage with high concentration of fiber generally will support less animal production than will low fiber forage. Concentration of NDF, ADF and Cellulose are also negatively correlated to quality because forage with high concentration of these fiber fractions contain less available energy are consumed in less amounts by animal than are forages with low amounts of these fractions. Keeping in view the above facts it was concluded from the present study that the newly developed genotypes/strains G 48 1/7, G 161 1/28, G 162 1/29, G-165 1/32, G-191 2/22, G-199, 2/26, S-533 3/7, S-534 3/8, S-536 3/9, IS-65 13/13, IS-1032 3/15, IS 3225 3/13, IS-4718 3/37, IS-5413 3/34, SRF-285 5/8, UTFS-43 5/42, EJ-66-1 4/27, UTMCH-1302, WT-51 4/15, EJ-66 4/27, PC 2RG 5/15, UTFS-37 5/9, EJ-167 2/3, EJ104 4/17 and HV11 4/7 were superior sorghum fodder strain over check variety SSG 59-3 and others were at par or having high fiber fractions (Table 15).

**Trial 13: Assessment of sorghum grain as an alternate source of energy in the ration of calves (Hisar)**

Eight crossbred calves having average body weight of 90 kg have been selected and divided into two groups, G-I and G-II, of four each. Calves of G-I are feeding maize grain (as an energy source) based concentrate mixture while of G-II are feeding sorghum grain (as energy source) based concentrate mixture. The experiment is in progress and results will be submitted in the month of April, 2008.

**Table 15. Chemical composition of promising strains of sorghum multicut fodder**

S.No	Name	DM	CP	CF	NDF	ADF	H.Cel	Cell
1	G48 1/7	23.48	7.69	28.73	65.30	42.57	22.73	29.43
2	G161,1/28	22.37	7.23	30.53	66.81	45.46	21.41	32.33
3	G162 1/29	22.43	7.67	28.00	66.11	43.13	22.98	29.83
4	G-165 1/32	24.11	7.80	27.53	65.76	43.33	22.43	28.93

S.No	Name	DM	CP	CF	NDF	ADF	H.Cel	Cell
5	G191 2/22	20.47	7.20	29.53	65.37	42.41	22.96	29.53
6	G199 2/26	22.30	7.45	27.63	64.43	43.37	21.06	30.11
7	S533 3/7	22.07	7.21	30.78	65.78	45.00	20.78	32.91
8	S534 3/8	21.71	7.87	28.34	64.41	43.48	20.93	29.53
9	S536 3/9	20.48	7.91	27.18	65.30	44.78	20.52	30.11
10	IS65 13/13	20.00	7.50	27.43	63.37	43.00	20.37	28.78
11	IS1032-1 3/15	21.43	7.56	26.58	64.87	44.71	20.17	29.53
12	IS 3225 3/24	20.88	6.94	28.89	66.17	44.23	21.94	32.90
13	IS 4718 3/37	19.88	7.84	28.17	65.00	43.12	21.88	29.53
14	IS 5413 3/34	21.17	7.80	27.98	66.00	42.87	23.16	28.78
15	SRF 285 5/8	22.10	7.39	27.42	64.05	43.33	20.72	28.53
16	UTFS 43 5/42	22.40	7.56	30.43	65.73	43.00	22.73	29.82
17	EJ 66-1 4/27	21.31	7.29	29.00	66.30	43.71	22.59	29.50
18	SRV 5 5/3	20.40	7.00	26.99	64.30	43.01	21.29	28.78
19	UTMCH 1302	20.11	6.60	27.45	65.31	42.97	22.34	29.11
20	WT51 4/15	20.50	7.45	27.91	64.17	43.71	20.46	30.13
21	EJ 66 4/27	20.45	7.61	27.35	65.71	42.44	23.27	29.21
22	PC2 RG 5/15	21.55	7.23	27.23	64.30	41.71	22.59	28.41
23	UTFS37 5/9	23.78	7.45	28.45	65.89	42.37	23.52	29.53
24	EJ167 2/3	22.36	7.51	27.23	64.90	43.12	21.78	30.00
25	E104 4/17	22.71	7.63	27.12	64.80	42.42	22.43	29.11
26	HV11 4/7	24.03	7.40	28.97	65.74	44.31	21.43	33.18
27	SSG59-3	23.74	7.17	30.21	66.98	44.36	22.62	30.19
	SE	0.19	0.04	0.2	0.24	0.24	0.12	0.18

## Forage entomology and pathology

Since the work in these areas was confined to the data recorded on pests and diseases in breeding trials and no separate experiments were conducted, these were discussed in the breeding section itself

## Dual-purpose sorghum trials

### Summary

**Introduction:** During the kharif season of 2007, an Advanced Varietal and Hybrid trial (AVHT &) Initial Varietal Trial (IVT) were organized from NRCS under AICSIP for testing under zones I, II and III.

**AVHT:** Eleven entries including 8 test varieties, 1 varietal check, 1 test and check hybrids were tested across 15 locations.

#### Highlights:

- ❖ In Zone I, SPV 1779 and SPV 1754 were the promising entries for stover yield, biomass and plant height .
- ❖ In Zone II, SPV 1782 and SPV 1779 were the superior entries for biomass and leaf width while SPH 1467 was promising for grain yield and biomass.
- ❖ In Zone III, SPV 1781 and SPV 1754 were better for both grain and fodder yields.
- ❖ At All India level, SPV 1779, SPV 1781, SPV 1754 and SPV 1782 were promising entries. The hybrid SPH 1467 performed better than the check for grain yield in all the zones and at all India level and for fodder yield in Zone II.
- ❖ With respect to shoot fly resistance, the entries SPV 1754 and SPV 1779 were found superior compared to other entries while for stem borer resistance, SPV 1750, SPV 1616, SPV 1779, SPV 1778, SPV 1754 and SPH 1467 were promising.
- ❖ All the test entries were highly susceptible to grain molds and none were found to have any resistance to grain molds. SPV 1779 recorded lowest downy mildew incidence.

**Conclusions:** SPV 1779, SPV 1781, SPV 1754 and SPV 1782 were promising entries which can be promoted.

**Initial Varietal trial:** Eight entries including check were tested across 14 locations.

#### Highlights:

- ❖ In all the 3 zones and at All India level, SPV 1822 and SPV 1823 performed consistently for grain and fodder yields and biomass.
- ❖ SPV 1616, SPV 1823 and SPV 1824 were found superior for stem borer resistance.

- ❖ All the test entries were highly susceptible to grain molds and none were found to have any resistance to grain molds.
- ❖ SPV 1822 was observed to have multiple resistances to Anthracnose, zonate leaf spot and downy mildew.
- ❖ SPV 1823 and SPV 1824 were also resistant to Anthracnose.

**Conclusions:** SPV 1822 and SPV 1823 are the entries which can be promoted to Advanced Varietal Trial.

## Dual purpose sorghum 2007-08: Detailed report

In pursuance of the decision taken at the XXXVII Annual group meeting held at MPUAT, Udaipur during 5<sup>th</sup> April, 2007, an AVHT & IVT were organized from NRCS for testing in the kharif season of 2007.

### Advanced Varietal Hybrid Trial

Eleven entries including 8 test varieties, 1 test hybrid & 1 varietal and 1 hybrid check were tested across 15 locations under Zones 1, 2 & 3.

**Zone I:** The data from Coimbatore and Palem for grain and fodder yields indicate the following results (Table 1).

#### **Yield traits**

**Grain yield:** The grain yield of test varieties ranged between 3849 kg/ha and 4832 kg/ha compared to the check CSV 15 (4835 kg/ha). The entries were neither significantly nor numerically superior to CSV 15. The test hybrid SPH 1467 recorded a numerical superiority of 9% over the check CSH 18.

**Stover yield:** The stover yield ranged from 182 to 251q/ha in the test varieties compared to 182 q/ha in the check CSV 15. SPV 1779 significantly out yielded the check CSV 15 by 37%. SPV 1754 and SPV 1781 were the other varieties which recorded a significant superiority of 32 and 27% over the check. The test hybrid was on par to the check hybrid.

**Biomass:** SPV 1779 and SPV 1754 recorded a significant superiority of 26 and 21% over the check CSV 15. The other entries which had a numerical superiority were SPV 1781, SPV 1782 and SPV 1778. The test hybrid was on par to the check hybrid.

#### **Morpho-phenological traits**

**Days to 50% flowering:** The test entries flowered similar to the checks.

**Days to maturity:** All the test entries were on par to the checks in maturity. SPH 1467 (101 days) was early maturing compared to the check hybrid CSH 18 (104 days).

**Plant height:** SPV 1782 was the tallest followed by SPV 1754, SPV 1779 and SPV 1781 and were significantly superior to CSV 15.

**Grain weight:** SPV 1781 recorded maximum test weight of 31 g/1000 grain among varieties followed by SPV 1779 (29 g/1000 grain). SPH 1467 recorded 28 g/1000 grain among hybrids.

#### **Forage traits**

**Leaf length:** The test varieties which exhibited significant superiority over check CSV 15 were SPV 1753, SPV 1779, SPV 1750 and SPV 1782. The test hybrid SPH 1467 also exhibited significant superiority over the check CSH 18 for leaf length.

**Leaf width:** Among varieties, SPV 1779 and SPV 1753 followed by SPV 1781, SPV 1778, SPV 1782 and SPV 1754 were numerically superior to CSV 15.

**No. of leaves:** SPV 1782 (13) followed by SPV 1754 (12) and SPV 1778 (12) recorded highest number of leaves.

#### **Zone II:**

#### **Yield traits**

**Grain yield:** The data from Mandya and Surat centres (Table 2) indicates that SPV 1753 and SPV 1779 had numerical superiority of 12 and 10% over CSV 15. The test hybrid SPH 1467 was numerically superior to CSH 18 by 8%.

**Fodder yield:** In this zone, maximum fodder yield was recorded by SPV 1782 (133 q/ha) which was 35% significantly superior to the check CSV 15 (98 q/ha).

**Biomass:** SPV 1782 and SPV 1779 recorded a numerical superiority over the check CSV 15 while SPH 1467 was 14% numerically superior compared to the check hybrid CSH 18.

#### **Morpho-phenological traits**

**Days to flowering:** SPV 1753 was significantly early as compared to CSV 15 by 9 days. SPH 1467 was earlier to the check CSH 18 by 5 days.

**Days to maturity:** The test entries matured similar to the checks.

**Plant height:** Variation for plant height was from 184-246 cm.

**Grain weight:** SPV 1616 had maximum grain size (28 g/1000 grain) as against 26 g/1000 grain in CSV 15.



### ***Forage traits***

**Leaf length:** SPV 1778 (96 cm) followed by SPV 1781 (94 cm) recorded maximum leaf length compared to 77 cm in CSV 15.

**Leaf width:** SPV 1782 and SPH 1467 recorded maximum leaf width among the entries.

**Number of leaves:** SPV 1616 recorded maximum number of leaves.

**Zone III:** Based on data from Deesa, Udaipur, Mauranipur, Pantnagar, Avikanagar, Hisar, Ranchi, Kanpur, Gwalior and Ludhiana for grain yield & from the same locations excluding Gwalior for fodder yield, following conclusions are drawn (Table 3).

### ***Yield traits***

**Grain yield:** None of the test varieties have recorded any superiority over the check CSV 15. The hybrid SPH 1467 was 7% numerically superior to CSH 18.

**Stover yield:** The varieties SPV 1754 and SPV 1781 recorded numerical superiority of over 8% over the check CSV 15. The test hybrid was on par to the check CSH 18.

**Biomass:** Similar to stover yield, the varieties SPV 1754 and SPV 1781 recorded a numerical superiority over the check CSV 15 while SPH 1467 was on par to the check hybrid CSH 18.

### ***Morpho-phenological traits***

**Days to flower:** SPV 1750 and SPH 1467 were significantly earlier than their respective checks by 3 and 8 days.

**Days to maturity:** All the varieties & hybrids were on par to their respective checks.

**Plant height** SPV 1781 was tallest followed by SPH 1467.

**Grain weight:** SPV 1616, SPV 1781 and SPV 1754 were significantly superior to the check CSV 15. The hybrid was on par to the check CSH 18.

### ***Forage traits***

**Leaf length:** SPV 1753 followed by SPV 1750 recorded highest leaf length.

**Leaf width:** SPV 1781 recorded maximum leaf width among the test varieties while the check hybrid was superior to the test hybrid for this character.

**Number of leaves:** SPV 1754 recorded maximum number of leaves

### ***All India***

#### ***Yield traits***

**Grain yield:** None of the test varieties were significantly superior to CSV 15. However, SPV no's 1750, 1753, 1616, 1779, 1782 and 1778 were statistically on par. The test hybrid SPH 1467 was 8% numerically superior to CSH 18 (Table 4).

**Stover yield** SPV 1754 (13%), SPV 1781 (10%) and SPV 1779 (9%) recorded significant superiority over CSV 15 for this character. The test hybrid was on par to CSH 18.

**Biomass:** SPV 1754 recorded 9% significant superiority over CSV 15 while SPV 1781 (7%), SPV 1779 (7%) and SPV 1782 (6%) were numerically superior over the same check. SPH 1467 was on par to the check hybrid CSH 18.

#### ***Morpho-phenological traits***

**Days to flower:** SPV 1750 and SPH 1467 were significantly earlier than their respective checks by 3 and 8 days.

**Days to maturity:** All the varieties & hybrids were on par to their respective checks.

**Plant height** SPV 1781 was tallest followed by SPH 1467.

**Grain weight:** SPV 1781, SPV 1616, SPV 1754 and SPV 1779 were significantly superior to the check CSV 15 while test hybrid was on par to the check hybrid.

#### ***Forage traits***

**Leaf length:** SPV 1753 followed by CSH 18 recorded highest leaf lengths.

**Leaf width:** SPV 1782 recorded maximum leaf width among the test varieties while the check hybrid was superior to the test hybrid.

**Number of leaves:** SPV 1754 recorded maximum number of leaves

**Conclusions:** In Zone I, SPV No's 1750, 1782, 1753, 1779, 1754 and SPV 1781 and SPV 1779, SPV 1753 and 1782 in Zone II, SPV 1750, SPV 1781 and SPV 1754 in Zone III were promising for both grain and fodder yields. At all India level, SPV 1779, SPV 1781, SPV 1754 and SPV 1782 were promising for grain and fodder yields. The hybrid SPH 1467 performed better than the check for grain yield in all the zones and at all India level and for fodder yield in Zone II. With respect to shoot fly resistance, the entries SPV 1754 and SPV 1779 were found superior compared to other entries while for stem borer resistance, SPV 1750 and SPV 1616 were promising. All the test entries were highly susceptible to

grain molds and none were found to have any resistance to grain molds as indicated by overall mean field grade (4.7) as well as threshed grade mold (5.3) incidence. SPV 1779 recorded lowest downy mildew incidence.

### **Initial Varietal Trial**

Eight entries including check were tested across 14 locations under Zones I, II & III.

**Zone I:** Based on the performance of entries and data collected from Coimbatore alone for grain yield and both Palem and Coimbatore for fodder yields, the following conclusions are drawn (Table 5).

#### ***Yield traits***

**Grain yield:** None of the test varieties were superior to the best check CSV 15 which recorded a grain yield of 5038 Kg/ha. However, entries SPV 1823 and SPV 1822 were on par with the check.

**Fodder yield** In this zone, compared to the check, the varieties SPV 1826, SPV 1825, SPV 1821 and SPV 1823 recorded numerical superiority of 20%, 18%, 15% and 11% respectively.

**Biomass:** The range of biomass was 223 to 262 q/ha compared to the check CSV 15 (244 q/ha). The varieties SPV 1826 and SPV 1823 recorded the numerical superiority of 7% and 5.2% over the check CSV 15.

#### ***Morpho-phenological traits***

**Days to flowering:** Most of the varieties flowered in the range of the check except SPV 1821 which was significantly early and SPV 1825 which was significantly late.

**Days to maturity:** The test entries matured similar to the check except SPV 1821 which significantly matured earlier than the check by 6 days. SPV 1825 was observed to be significantly late in duration.

**Plant height** SPV 1821 was the tallest followed by SPV 1826 and SPV 1825 and were significantly superior to the check.

**Grain weight:** SPV 1821 was a bold seeded variety with a grain weight of 30 g/1000 grain and was significantly superior to the check.

#### ***Forage traits***

**Leaf length:** The maximum leaf length of 92.5 cm which was significant was recorded by SPV 1825.

**Leaf width:** Among the varieties, SPV 1825 (9.77 cm) recorded more leaf width than the check

**Number of leaves:** and SPV 1825 (14) and SPV 1821 (14) recorded maximum number of leaves.

**Zone II:** The data from Surat alone indicates the following results (Table 6).

#### ***Yield traits***

**Grain yield:** The varieties SPV 1822 (176%), SPV 1823 (163%) SPV 1616 (55%) recorded highly significant superiority over the check CSV 15.

**Fodder yield:** None of the varieties have recorded significant superiority over the check. However, the entries SPV 1821, SPV 1825, SPV 1822 and SPV 1823 were numerically superior to the check.

**Biomass:** The highest biomass was recorded by SPV 1821.

#### ***Morpho-phenological traits***

**Days to flowering:** The test varieties flowered similar to the check.

**Days to maturity:** The entry SPV 1822 was significantly earlier in maturity compared to the check by 5 days.

**Plant height** SPV 1821 (278 cm) showed significant superiority over the check.

**Grain weight:** All the varieties were on par to the check.

#### ***Forage traits***

**Leaf length:** SPV 1821 (96.3 cm) showed significantly more leaf length compared to the check.

**Leaf width:** SPV 1824 (11.2 cm) recorded significantly more leaf width than the check.

**Number of leaves:** SPV 1821 (17) recorded more number of leaves and was significantly superior to the check for this character.

**Zone III:** Based on the data of 8 locations the following conclusions were drawn (Table 7).

#### ***Yield traits***

**Grain yield:** Among the varieties, SPV 1822 recorded a numerical superiority of 8% over the check CSV 15.

**Fodder yield:** Highest fodder yield was recorded by SPV 1821 (204 q/ha) followed by SPV 1823 (202 q/ha), SPV 1822 (201 q/ha), which were numerically superior to the check by 7%, 6% and 6% respectively.

**Biomass:** The highest biomass was recorded by SPV 1822 followed by SPV 1823.

### ***Morpho-phenological traits***

**Days to flowering:** Except SPV 1825 (88 days), all the test entries flowered similar to check.

**Days to maturity:** All the varieties were on par to CSV 15 for this character except SPV 1825 which was significantly late in duration as compared to the check.

**Plant height:** SPV 1821 was significantly taller compared to the check.

**Grain weight:** SPV 1616 (28 g/1000 grain) followed by SPV 1825 (27.7/1000 grain) recorded maximum test weight.

### ***Forage traits***

**Leaf length:** SPV 1825 (81.2 cm) recorded significant leaf length.

**Leaf width:** Similar to leaf length, SPV 1825 (8.24 cm) recorded significantly more leaf width.

**Number of leaves:** SPV 1825 (14.3) recorded significantly more number of leaves as compared to the check.

**All India:** Based on the data from 10 locations for grain yield and 12 locations for fodder yield, the following conclusions were drawn (Table 8).

### ***Yield traits***

**Grain yield:** The test variety SPV 1822 recorded a numerical superiority of 13% over the check.

**Fodder yield:** Highest fodder yield was recorded by SPV 1821 (195 q/ha) and was 12% superior to CSV 15. The other promising entries were SPV 1823 and SPV 1822.

**Biomass:** SPV 1823 and SPV 1822 recorded 7% and 6.1% numerical superiority over the check.

### ***Morpho-phenological traits***

**Days to flower:** SPV 1821 was significantly early by 3 days while SPV 1825 was late by 10 days compared to the check.

**Days to maturity:** All the entries matured similar to CSV 15 except SPV 1825

**Plant height:** SPV 1821 (288 cm) followed by SPV 1826 (256 cm) and SPV 1825 (246 cm) recorded the maximum plant height.

**Grain weight:** Significant grain weight was recorded by the variety SPV 1616 (28 g/1000 grain) compared to the check.

### ***Forage traits***

**Leaf length:** SPV 1825 (83.3 cm) and SPV 1824 (80.3 cm) recorded maximum leaf length.

**Leaf width:** SPV 1825 followed by SPV 1824 recorded significantly higher leaf width as compared to the check.

**Number of leaves:** SPV 1825 and SPV 1821 recorded significantly more number of leaves as compared to the check.

**Conclusions:** In all the 3 zones and at All India level, SPV 1822 and SPV 1823 performed consistently for grain and fodder yields and biomass. SPV 1616, SPV 1823 and SPV 1824 were found superior for stem borer resistance. All the test entries were highly susceptible to grain molds and none were found to have any resistance to grain molds as indicated by overall mean field grade (4.6) as well as threshed grade mold (5.2) incidence. SPV 1826 and SPV 1822 recorded lowest downy mildew incidence.

**Table 1: Summary of Performance of Varieties and Hybrids in Zone I - Dual Purpose AVHT - Kharif 2007**

S. No.	Variety name	GY		%+ over CSV 15		FY		BM		%+ over CSV 15		SF - DH		SB - DH		GMFG		GMTG		DMSI	
			R		R		R		R		R		R		R		R		R		R
1	SPV 1778	4143	8	-14.3	22127	5	21.3	26271	7	13.9	43.5	10	10.4	9	5.3	13	6.1	14	9.54	11	
2	SPH 1467	5320	1	8.9	21426	7	-4.6	26747	5	-2.2	45.4	14	10.1	7	4.9	8	5.7	6	6.04	8	
3	SPV 1781	4060	9	-16.0	23198	3	27.2	27258	4	18.1	40.0	8	11.1	13	4.9	10	5.8	8	6.03	7	
4	SPV 1754	3849	11	-20.4	24092	2	32.1	27941	2	21.1	36.2	5	10.6	10	4.6	5	5.5	5	5.82	4	
5	SPV 1753	4363	6	-9.8	20803	8	14.1	25167	8	9.1	44.6	12	11.1	12	5.5	15	6.0	13	7.49	10	
6	SPV 1616	4345	7	-10.1	20083	9	10.1	24427	9	5.9	40.1	9	8.3	5	5.1	12	6.0	11	5.86	5	
7	SPV 1750	4832	4	-0.1	19264	10	5.6	24097	10	4.4	43.6	11	7.8	3	5.0	11	5.8	7	5.90	6	
8	SPV 1779	3899	10	-19.4	25075	1	37.5	28974	1	25.6	39.6	6	10.0	6	4.9	9	5.9	9	4.05	2	
9	CSV 15	4835	3	0.0	18238	11	0.0	23073	11	0.0	39.6	7	10.9	11	4.9	6	6.2	15	6.67	9	
10	SPV 1782	4671	5	-3.4	21759	6	19.3	26431	6	14.6	45.1	13	12.2	14	4.9	7	5.3	4	5.76	3	
11	CSH 18	4885	2	0.0	22470	4	0.0	27355	3	0.0	46.4	15	12.3	15	5.4	14	6.0	10	4.05	1	
12	Local Check										30.5	4	10.3	8	3.3	4	6.0	12	20.76	12	
13	IS 2312 (R) / B 58586(R)										23.9	3	8.2	4	2.9	3	3.2	3	-		
14	IS 2205 (R) / IS 14332(R)										17.2	1	5.9	1	2.7	2	2.7	2	-		
15	IS 18551 (R) / IS 14338(R)										18.7	2	6.7	2	2.3	1	2.2	1	-		
16	DJ 6514 (S) / K. Local(S)										80.6	16	14.9	16	-		-		-		
	LOC. MEAN	4473			21685			26158			39.7		10.0		4.7		5.3		7.43		
	C.D. (5%)	1313			4361			4321			18.8		5.2		2.1		4.4		5.21		
	C.D. (1%)	1868			6204			6145			25.3		6.9		2.8		6.2		7.08		
	C.V. (%)	13.18			9.03			7.41			28.36		36.13		31.56		35.11		34.32		
	F (Probability)	0.36			0.12			0.21			0.00		0.12		0.93		0.93		0.00		

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF -DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG-Grain mold threshed grade(1-5), DMSI - Downy mildew systemic infection (%)

**Table 2: Summary of Performance of Varieties and Hybrids in Zone II - Dual Purpose AVHT - Kharif 2007**

S. No.	Variety name	GY	R	%+ over CSV 15	FY	R	%+ over CSV 15	BM	R	%+ over CSV 15	SF-DH	R	SB-DH	R	GMFG	R	GMTG	R	DMSI	R
1	SPV 1778	2057	7	-6.5	10571	5	7.5	12628	6	5.0	43.5	10	10.4	9	5.3	13	6.1	14	9.54	11
2	SPH 1467	3068	1	7.9	10348	7	15.6	13416	3	13.7	45.4	14	10.1	7	4.9	8	5.7	6	6.04	8
3	SPV 1781	1833	10	-16.7	10523	6	7.1	12356	7	2.7	40.0	8	11.1	13	4.9	10	5.8	8	6.03	7
4	SPV 1754	1452	11	-34.0	11773	2	19.8	13225	4	9.9	36.2	5	10.6	10	4.6	5	5.5	5	5.82	4
5	SPV 1753	2455	3	11.6	8793	10	-10.5	11248	10	-6.5	44.6	12	11.1	12	5.5	15	6.0	13	7.49	10
6	SPV 1616	1986	9	-9.7	8781	11	-10.7	10767	11	-10.5	40.1	9	8.3	5	5.1	12	6.0	11	5.86	5
7	SPV 1750	2029	8	-7.8	10899	4	10.9	12928	5	7.5	43.6	11	7.8	3	5.0	11	5.8	7	5.90	6
8	SPV 1779	2426	4	10.3	11542	3	17.4	13968	2	16.1	39.6	6	10.0	6	4.9	9	5.9	9	4.05	2
9	CSV 15	2200	6	0.0	9829	8	0.0	12029	8	0.0	39.6	7	10.9	11	4.9	6	6.2	15	6.67	9
10	SPV 1782	2291	5	4.1	13302	1	35.3	15593	1	29.6	45.1	13	12.2	14	4.9	7	5.3	4	5.76	3
11	CSH 18	2844	2	0.0	8953	9	0.0	11797	9	0.0	46.4	15	12.3	15	5.4	14	6.0	10	4.05	1
12	Local Check										30.5	4	10.3	8	3.3	4	6.0	12	20.76	12
13	IS 2312 (R) / B 58586(R)										23.9	3	8.2	4	2.9	3	3.2	3	-	
14	IS 2205 (R) / IS 14332(R)										17.2	1	5.9	1	2.7	2	2.7	2	-	
15	IS 18551 (R) / IS 14338(R)										18.7	2	6.7	2	2.3	1	2.2	1	-	
16	DJ 6514 (S) / K. Local(S)										80.6	16	14.9	16	-		-		-	
	LOC. MEAN	2240			10483			12723			39.7		10.0		4.7		5.3		7.43	
	C.D. (5%)	1352			3310			3774			18.8		5.2		2.1		4.4		5.21	
	C.D. (1%)	1923			4708			5367			25.3		6.9		2.8		6.2		7.08	
	C.V. (%)	27.09			14.17			13.31			28.36		36.13		31.56		35.11		34.32	
	F (Probability)	0.43			0.19			0.36			0.00		0.12		0.93		0.93		0.00	

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)

**Table 3: Summary of Performance of Varieties and Hybrids in Zone III - Dual Purpose AVHT - Kharif 2007**

S. No.	Variety name	GY		%+ over CSV 15	FY		%+ over CSV 15	BM		%+ over CSV 15	SF-DH		SB-DH		GMFG		GMTG		DMSI	
			R			R			R		R	R	R	R	R	R	R	R	R	R
1	SPV 1778	1767	8	-13.1	21218	8	-2.0	23355	9	-2.9	43.5	10	10.4	9	5.3	13	6.1	14	9.54	11
2	SPH 1467	2447	1	6.9	20816	10	-3.8	23528	8	-3.7	45.4	14	10.1	7	4.9	8	5.7	6	6.04	8
3	SPV 1781	1735	9	-14.7	23301	2	7.6	25331	2	5.4	40.0	8	11.1	13	4.9	10	5.8	8	6.03	7
4	SPV 1754	1649	11	-18.9	23631	1	9.1	25615	1	6.5	36.2	5	10.6	10	4.6	5	5.5	5	5.82	4
5	SPV 1753	1991	6	-2.1	20732	11	-4.3	22897	11	-4.8	44.6	12	11.1	12	5.5	15	6.0	13	7.49	10
6	SPV 1616	2068	3	1.7	20947	9	-3.3	23322	10	-3.0	40.1	9	8.3	5	5.1	12	6.0	11	5.86	5
7	SPV 1750	2014	5	-1.0	21503	7	-0.7	23733	7	-1.3	43.6	11	7.8	3	5.0	11	5.8	7	5.90	6
8	SPV 1779	1835	7	-9.8	22458	4	3.7	24615	3	2.4	39.6	6	10.0	6	4.9	9	5.9	9	4.05	2
9	CSV 15	2034	4	0.0	21659	5	0.0	24043	6	0.0	39.6	7	10.9	11	4.9	6	6.2	15	6.67	9
10	SPV 1782	1704	10	-16.2	22524	3	4.0	24568	4	2.2	45.1	13	12.2	14	4.9	7	5.3	4	5.76	3
11	CSH 18	2288	2	0.0	21643	6	0.0	24427	5	0.0	46.4	15	12.3	15	5.4	14	6.0	10	4.05	1
12	Local Check										30.5	4	10.3	8	3.3	4	6.0	12	20.76	12
13	IS 2312 (R) / B 58586(R)										23.9	3	8.2	4	2.9	3	3.2	3	-	
14	IS 2205 (R) / IS 14332(R)										17.2	1	5.9	1	2.7	2	2.7	2	-	
15	IS 18551 (R) / IS 14338(R)										18.7	2	6.7	2	2.3	1	2.2	1	-	
16	DJ 6514 (S) / K. Local(S)										80.6	16	14.9	16	-		-		-	
	LOC. MEAN	1958			21857			24130			39.7		10.0		4.7		5.3		7.43	
	C.D. (5%)	355			2422			2450			18.8		5.2		2.1		4.4		5.21	
	C.D. (1%)	470			3209			3246			25.3		6.9		2.8		6.2		7.08	
	C.V. (%)	20.39			12.47			11.43			28.36		36.13		31.56		35.11		34.32	
	F (Probability)	0.00			0.23			0.47			0.00		0.12		0.93		0.93		0.00	

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)

**Table 4: Summary of Performance of Varieties and Hybrids in All India - Dual Purpose AVHT - Kharif 2007**

S. No.	Variety name	GY	%+ over CSV 15	FY	%+ over CSV 15	BM	%+ over CSV 15	SF-DH	SB-DH	GMFG	GMTG	DMSI
		R	R	R	R	R	R	R	R	R	R	R
1	SPV 1778	2148	-12.6	19827	1.8	22239	0.2	43.5	10.4	5.3	6.1	9.54
2	SPH 1467	2946	7.6	19408	-2.7	22543	-2.2	45.4	10.1	4.9	5.7	6.04
3	SPV 1781	2081	-15.3	21461	10.2	23753	7.1	40.0	11.1	4.9	5.8	6.03
4	SPV 1754	1935	-21.3	22003	12.9	24178	9.0	36.2	10.6	4.6	5.5	5.82
5	SPV 1753	2396	-2.5	19037	-2.3	21557	-2.8	44.4	11.1	5.5	6.0	7.49
6	SPV 1616	2382	-3.1	19085	-2.0	21686	-2.3	40.1	8.3	5.1	6.0	5.86
7	SPV 1750	2419	-1.6	19668	1.0	22242	0.2	43.4	7.8	3	5.0	5.90
8	SPV 1779	2214	-9.9	21272	9.2	23717	6.9	39.6	10.0	4.9	5.9	4.05
9	CSV 15	2458	0.0	19481	0.0	22188	0.0	39.6	10.9	11	6.2	6.67
10	SPV 1782	2212	-10.0	21097	8.3	23552	4	45.1	12.2	4.9	5.3	5.76
11	CSH 18	2739	0.0	19948	0.0	23041	0.0	46.4	12.3	15	6.0	4.05
12	Local Check							30.5	10.3	8	6.0	20.76
13	IS 2312 (R) / B 58586(R)							23.9	8.2	4	3	3
14	IS 2205 (R) / IS 14332(R)							17.2	5.9	1	2	2
15	IS 18551 (R) / IS 14338(R)							18.7	6.7	2	2	1
16	DJ 6514 (S) / K. Local(S)							80.4	14.9	16		
	LOC. MEAN	2357		20208		22790		39.7	10.0	4.7	5.3	7.43
	C.D. (5%)	325		1850		1869		18.8	5.2	2.1	4.4	5.21
	C.D. (1%)	429		2444		2469		25.3	6.9	2.8	6.2	7.08
	C.V. (%)	18.41		12.24		10.97		28.36	36.13	31.56	35.11	34.32
	F (Probability)	0.00		0.01		0.06		0.00	0.12	0.93	0.93	0.00

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)

Table 5: Summary of Performance of Varieties in Zone I- Dual Purpose IVT - Kharif 2007

S .No.	Variety name	Centrecode	GY		%+ over CSV 15	FY		%+ over CSV 15	BM		%+ over CSV 15	SF-DH		SB-DH		GMFG		GMTG		DMSI	
				R			R			R			R		R		R		R		R
1	SPV 1822	SU 1237	4929	3	-2.2	19019	6	-3.5	23285	6	-4.9	39.7	7	12.0	10	5.4	11	5.9	9	4.05	2
2	SPV 1823	SU 1242	4955	2	-1.6	21977	4	11.5	25776	2	5.2	41.9	10	8.5	5	5.5	12	6.0	12	6.70	8
3	SPV 1616	SPV 1616	4702	4	-6.7	18076	8	-8.3	22544	7	-7.9	36.6	6	7.8	4	4.7	6	5.3	5	5.06	4
4	CSV 15	CSV 15	5038	1	0.0	19705	5	0.0	24491	4	0.0	36.0	5	11.1	9	5.1	9	5.4	6	5.06	3
5	SPV 1824	DSV 6	4224	5	-16.2	18856	7	-4.3	22350	8	-8.7	40.3	9	10.9	7	5.2	10	5.6	8	5.76	5
6	SPV 1821	E 68-1	1440	8	-71.4	22683	3	15.1	24424	5	-0.3	42.4	11	11.0	8	5.0	8	6.0	11	6.12	6
7	SPV 1825	NSSV 254	2160	7	-57.1	23296	2	18.2	25337	3	3.5	39.8	8	15.0	12	5.0	7	5.6	7	6.57	7
8	SPV 1826	NSSV 256	2659	6	-47.2	23701	1	20.3	26217	1	7.0	47.6	12	13.3	11	4.5	5	5.3	4	4.05	1
9	Local Check	Local Check										26.1	4	9.6	6	3.8	4	5.9	10	20.43	9
10	IS 2312 (R) / B 58586(R)	Ento. Res / Patho. Res										20.9	3	6.8	3	2.9	3	3.3	3	-	-
11	IS 2205 (R) / IS 14332(R)	Ento. Res / Patho. Res										15.9	2	6.4	1	2.2	1	2.3	1	-	-
12	IS 18551 (R) / IS 14338(R)	Ento. Res / Patho. Res										14.7	1	6.6	2	2.5	2	2.9	2	-	-
13	DJ 6514 (S) / K. Local(S)	Ento. Susc/Patho. Susc										83.9	13	17.1	13	-	-	-	-	-	-
	LOC. MEAN		3763			20914			24303			37.0		10.3		4.6		5.2		7.09	
	C.D. (5%)		449			4579			5086			25.2		6.7		2.3		6.9		4.78	
	C.D. (1%)		623			6777			7527			34.3		9.0		3.1		10.0		6.59	
	C.V. (%)		6.81			9.26			8.85			39.20		44.28		33.27		51.65		31.26	
	F (Probability)		0.00			0.11			0.54			0.01		1.00		1.00		0.91		0.00	

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)-28 DAE,SB-DH -Stem borer deadhearts(%)-45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI - Downy mildew systemic infection (%)



**Table 6: Summary of Performance of Varieties in Zone II - Dual Purpose IVT - Kharif 2007**

S. No.	Variety name	GY		%± over CSV 15		FY		%± over CSV 15		BM		%± over CSV 15		SF-DH		SB-DH		GMFG		GMTG		DMSI	
			R		R		R		R		R		R		R		R		R		R		R
1	SPV 1822	2997	1	176.5	10989	3	25.4	13308	3	33.4	39.7	7	12.0	10	5.4	11	5.9	9	4.05	2			
2	SPV 1823	2856	2	163.5	10919	4	24.6	13278	4	33.1	41.9	10	8.5	5	5.5	12	6.0	12	6.70	8			
3	SPV 1616	1679	3	54.9	9437	6	7.7	11015	6	10.4	36.6	6	7.8	4	4.7	6	5.3	5	5.06	4			
4	CSV 15	1084	5	0.0	8761	7	0.0	9977	7	0.0	36.0	5	11.1	9	5.1	9	5.4	6	5.06	3			
5	SPV 1824	1297	4	19.6	10243	5	16.9	11671	5	17.0	40.3	9	10.9	7	5.2	10	5.6	8	5.76	5			
6	SPV 1821	772	6	-28.8	12703	1	45.0	13976	1	40.1	42.4	11	11.0	8	5.0	8	6.0	11	6.12	6			
7	SPV 1825	-		-	11802	2	34.7	13333	2	33.6	39.8	8	15.0	12	5.0	7	5.6	7	6.57	7			
8	SPV 1826	625	7	-42.3	8317	8	-5.1	9395	8	-5.8	47.6	12	13.3	11	4.5	5	5.3	4	4.05	1			
9	Local Check										26.1	4	9.6	6	3.8	4	5.9	10	20.43	9			
10	IS 2312 (R) / B 58586(R)										20.9	3	6.8	3	2.9	3	3.3	3	-				
11	IS 2205 (R) / IS 14332(R)										15.9	2	6.4	1	2.2	1	2.3	1	-				
12	IS 18551 (R) / IS 14338(R)										14.7	1	6.6	2	2.5	2	2.9	2	-				
13	DJ 6514 (S) / K. Local(S)										83.9	13	17.1	13	-	-	-	-	-				
	LOC. MEAN	1616			10108			11711			37.0		10.3		4.6		5.2		7.09				
	C.D. (5%)	262			4800			5054			25.2		6.7		2.3		6.9		4.78				
	C.D. (1%)	367			7273			7657			34.3		9.0		3.1		10.0		6.59				
	C.V. (%)	9.12			19.24			17.50			39.20		44.28		33.27		51.65		31.26				
	F (Probability)				0.42			0.32			0.01		1.00		1.00		0.91		0.00				

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)

**Table 7: Summary of Performance of Varieties in Zone III - Dual Purpose IVT - Kharif 2007**

S. No.	Variety name	GY		%± over CSV 15	FY		%± over CSV 15	BM		%± over CSV 15	SF-DH		SB-DH		GMFG		GMTG		DMSI	
			R			R			R			R		R		R		R		R
1	SPV 1822	2580	1	7.8	20117	3	5.8	22802	1	6.1	39.7	7	12.0	10	5.4	11	5.9	9	4.05	2
2	SPV 1823	2180	4	-8.9	20207	2	6.3	22460	2	4.5	41.9	10	8.5	5	5.5	12	6.0	12	6.70	8
3	SPV 1616	2455	2	2.5	19038	5	0.1	21531	4	0.2	36.6	6	7.8	4	4.7	6	5.3	5	5.06	4
4	CSV 15	2394	3	0.0	19010	6	0.0	21494	5	0.0	36.0	5	11.1	9	5.1	9	5.4	6	5.06	3
5	SPV 1824	2135	5	-10.8	19311	4	1.6	21464	6	-0.1	40.3	9	10.9	7	5.2	10	5.6	8	5.76	5
6	SPV 1821	1642	7	-31.4	20445	1	7.5	21980	3	2.3	42.4	11	11.0	8	5.0	8	6.0	11	6.12	6
7	SPV 1825	1602	8	-33.1	17965	7	-5.5	19408	7	-9.7	39.8	8	15.0	12	5.0	7	5.6	7	6.57	7
8	SPV 1826	1650	6	-31.1	16669	8	-12.3	18188	8	-15.4	47.6	12	13.3	11	4.5	5	5.3	4	4.05	1
9	Local Check										26.1	4	9.6	6	3.8	4	5.9	10	20.43	9
10	IS 2312 (R) / B 58586(R)										20.9	3	6.8	3	2.9	3	3.3	3	-	
11	IS 2205 (R) / IS 14332(R)										15.9	2	6.4	1	2.2	1	2.3	1	-	
12	IS 18551 (R) / IS 14338(R)										14.7	1	6.6	2	2.5	2	2.9	2	-	
13	DJ 6514 (S) / K. Local(S)										83.9	13	17.1	13	-		-		-	
	LOC. MEAN	2080			19095			21166			37.0		10.3		4.6		5.2		7.09	
	C.D. (5%)	625			2779			2882			25.2		6.7		2.3		6.9		4.78	
	C.D. (1%)	834			3706			3843			34.3		9.0		3.1		10.0		6.59	
	C.V. (%)	29.91			14.48			13.55			39.20		44.28		33.27		51.65		31.26	
	F (Probability)	0.01			0.13			0.03			0.01		1.00		1.00		0.91		0.00	

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)

**Table 8: Summary of Performance of Varieties in All India - Dual Purpose IVT- Kharif 2007**

S. No.	Variety name	GY	R	%+ over CSV 15	FY	R	%+ over CSV 15	BM	R	%+ over CSV 15	SF-DH	R	SB-DH	R	GMFG	R	GMTG	R	DMSI	R
1	SPV 1822	2856	1	13.0	18413	3	5.7	21300	2	6.1	39.7	7	12.0	10	5.4	11	5.9	9	4.05	2
2	SPV 1823	2525	4	-0.1	18954	2	8.8	21483	1	7.0	41.9	10	8.5	5	5.5	12	6.0	12	6.70	8
3	SPV 1616	2602	2	3.0	17277	7	-0.8	19947	6	-0.6	36.6	6	7.8	4	4.7	6	5.3	5	5.06	4
4	CSV 15	2527	3	0.0	17417	6	0.0	20074	4	0.0	36.0	5	11.1	9	5.1	9	5.4	6	5.06	3
5	SPV 1824	2260	5	-10.6	17724	5	1.8	19980	5	-0.5	40.3	9	10.9	7	5.2	10	5.6	8	5.76	5
6	SPV 1821	1535	8	-39.3	19527	1	12.1	21053	3	4.9	42.4	11	11.0	8	5.0	8	6.0	11	6.12	6
7	SPV 1825	1664	6	-34.2	18374	4	5.5	19934	7	-0.7	39.8	8	15.0	12	5.0	7	5.6	7	6.57	7
8	SPV 1826	1648	7	-34.8	16449	8	-5.6	18060	8	-10.0	47.6	12	13.3	11	4.5	5	5.3	4	4.05	1
9	Local Check										26.1	4	9.6	6	3.8	4	5.9	10	20.43	9
10	IS 2312 (R) / B 58586(R)										20.9	3	6.8	3	2.9	3	3.3	3	-	-
11	IS 2205 (R) / IS 14332(R)										15.9	2	6.4	1	2.2	1	2.3	1	-	-
12	IS 18551 (R) / IS 14338(R)										14.7	1	6.6	2	2.5	2	2.9	2	-	-
13	DJ 6514 (S) / K. Local(S)										83.9	13	17.1	13	-	-	-	-	-	-
	LOC. MEAN	2202			17900			20113			37.0		10.3		4.6		5.2		7.09	
	C.D. (5%)	579			2184			2253			25.2		6.7		2.3		6.9		4.78	
	C.D. (1%)	772			2901			2993			34.3		9.0		3.1		10.0		6.59	
	C.V. (%)	28.35			14.91			13.63			39.20		44.28		33.27		51.65		31.26	
	F (Probability)	0.00			0.10			0.06			0.01		1.00		1.00		0.91		0.00	

R- Ranking, GY-Grain yield (kg/ha), FY - Dry fodder yield(kg/ha), BM - Biomass (kg/ha), SF-DH -Shoot Fly deadhearts(%)28 DAE,SB-DH -Stem borer deadhearts(%) 45 DAE, GMFG-Grain mold field grade (1-5), GMTG -Grain mold threshed grade(1-5), DMSI -Downy mildew systemic infection (%)