





**CROPS COVERED UNDER VARIABILITY STUDIES**



**Department of Agricultural Statistics**  
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**Anand Agricultural University**  
**Anand**



**Plan Scheme: “Statistical evaluation of experimental variability and strengthening research in Agricultural Statistics” (BH-12041)**

(Sanctioned vide office order No.GAU/Res/1(1)/18041-50/91,dated4-9-91)

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# **A RESEARCH COMPENDIUM ON STATISTICAL EVALUATION OF EXPERIMENTAL VARIABILITY FOR IMPROVING THE EFFICIENCY OF FIELD EXPERIMENTATION**

Year : July, 2024

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Scheme : Statistical evaluation of experimental  
variability and strengthening research in  
Agricultural Statistics (BH 12041)

Publication Series No.:

Published by : Department of Agricultural Statistics  
B. A. College of Agriculture  
Anand Agricultural University  
Anand – 388110



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### Message

I am pleased to present the updated section of our Research Compendium, "**Statistical Evaluation of Experimental Variability for Improving Efficiency of Field Experiments.**" This new section builds upon our research conducted after 2016, incorporating the latest findings from the past few years.

Our research team has meticulously analyzed chronological data on crop production, crop protection, and crop improvement research experiments for various crops, including sugarcane, maize, wheat, rice, tobacco, vegetable crops, and fodder crops. By examining yield data from numerous experiments conducted over 15 to 20 years, we have established reliable limits for accepting or rejecting results and developed a standard for measuring experimental variability (CV%).

The recent studies featured in this compendium encompass a diverse range of crops, with a focus on experimental variability. Our ultimate goal remains to enhance the reliability and efficiency of field experiments. The data presented in this compendium contribute significantly to academic knowledge and offer practical solutions for researchers.

I extend my sincere gratitude to our dedicated team of scientists and researchers whose tireless efforts have made this compendium possible. I also express my appreciation to our collaborators, university authorities, and everyone who has supported this project over the years.

As we continue to build upon our research legacy, I am confident that this updated compendium will serve as an indispensable resource for the agricultural research community, facilitating the planning of future research, accurate interpretation of experimental data, and the advancement of agricultural research practices.

Dr. A. D. Kalola

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# 1. Experimental Data

## 1.1 SUGARCANE

The secondary yield character data of 389 experiments conducted on Sugarcane crop at Navsari center during 1997-98 to 2014-2015 and reported in AGRESCO sub-committee meeting were obtained and further analyzed to develop yardstick of CV %. The upper fiducial limits and yardstick of CV % for accepting or rejecting the results of Sugarcane crop field experiments were worked out the upper fiducial limits at 95 % and 90 % confidence level based on non central t distribution were worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test.

**Table 1 : Upper fiducial limit of CV % for different disciplines of Sugarcane crop**

Discipline	No. of expt.	CV %	U L		Range		CV % >10.16	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Agronomy</b>	103	8.01	11.15	10.27	3.14	2.26	25	0.24
<b>Pl. Breeding</b>	286	7.89	9.81	9.33	1.91	1.44	27	0.09
<b>Mean</b>	<b>389</b>	<b>7.92</b>	<b>10.16</b>	<b>9.58</b>	-	-	-	-

**Table 2: Upper fiducial limit of CV % for different design Sugarcane crop**

Design	No. of expt.	CV %	U L		Range		CV % >10.16	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>FRBD</b>	7	8.86	10.65	10.22	1.79	1.37	1	0.14
<b>RBD</b>	363	7.98	10.25	9.66	2.26	1.68	70	19.28
<b>Split Plot</b>	19	6.40	8.32	7.82	1.92	1.42	1	5.26
<b>Mean</b>	<b>389</b>	<b>7.92</b>	<b>10.16</b>	<b>9.58</b>	-	-	-	-

**Table 3: Upper fiducial limit of CV % for different treatments of Sugarcane crop**

Treatments	No. of expt.	CV %	U L		Range		CV % >10.16	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
Up to 6	49	6.53	10.31	9.19	3.78	2.66	2	4.08
6-10	114	7.85	10.28	9.66	2.43	1.80	22	19.29
11-15	143	8.42	10.44	9.94	2.02	1.53	31	21.67
16-20	42	7.44	8.92	8.56	1.48	1.12	6	14.28
21-25	18	8.26	9.94	9.53	1.68	1.27	5	27.77
26-30	8	8.61	9.93	9.62	1.32	1.01	3	37.5
>30	15	8.88	10.01	9.75	1.14	0.88	3	20.00
<b>Mean</b>	<b>389</b>	<b>7.92</b>	<b>10.16</b>	<b>9.58</b>	-	-	-	-

**Table 4: Upper fiducial limit of CV % for different plot size of Sugarcane crop**

Plot size (m <sup>2</sup> )	No. of experiment	CV %	U L		Range		CV % >10.16	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<3	-	-	-	-	-	-	-	-
3-6	23	7.65	9.27	8.88	1.62	1.23	3	13.04
6-9	-	-	-	-	-	-	-	-
9-12	25	8.58	10.84	10.23	2.26	1.65	6	24.00
12-15	6	8.39	10.42	9.92	2.04	1.53	1	16.66
15-18	41	7.55	10.45	9.65	2.89	2.09	6	14.63
18-21	126	7.98	9.87	9.41	1.89	1.43	20	15.87
21-24	10	10.55	13.96	13.04	3.41	2.50	3	30.00
>24	158	7.73	10.09	9.48	2.36	1.75	33	20.88
<b>Mean</b>	<b>389</b>	<b>7.92</b>	<b>10.16</b>	<b>9.58</b>	-	-	-	-

**Table 5: Upper fiducial limit of CV % for different replications of Sugarcane crop**

Replication	No. of expt.	CV %	UL		Range		No. of expt.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
2	28	8.51	10.18	9.78	1.67	1.27	6	21.42
3	321	7.96	10.27	9.67	2.31	1.71	62	19.31



<b>4</b>	40	7.25	9.34	8.81	2.09	1.56	4	10.00
<b>Mean</b>	<b>389</b>	<b>7.92</b>	<b>10.16</b>	<b>9.58</b>	-	-	-	-

**Table 6: The average upper fiducial limit and yardstick for CV % for the experiments of Sugarcane crop**

Name of Crop	No. of experiments	Mean CV %	Upper fiducial limit of CV %		Overall yardstick of CV%
			0.95	0.90	
Sugarcane	389	7.92	10.16	9.58	11 %

**Table 7: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
<b>1-3</b>	1	1	0	0.00
<b>3-5</b>	42	41	1	0.02
<b>5-7</b>	119	113	6	0.05
<b>7-9</b>	103	97	6	0.06
<b>9-11</b>	72	58	14	0.24
<b>11-13</b>	32	24	8	0.33
<b>13-15</b>	2	9	0	0.00
<b>15-17</b>	10	2	8	4.00
<b>17-19</b>	1	1	0	0.00
<b>Total</b>	389	346	43	0.12

### **Recommendation for scientific community**

The yard stick of CV% for accepting the results of Sugarcane crop experiments is 11 per cent for yield character.

## 1.2 MAIZE

Yield data of 607 experiments conducted on Maize crop during the period 2002-03 to 2016-2017 were used to work out fiducial limits and yardstick of CV % for accepting or rejecting the results of Maize crop. The upper fiducial limits at 95 % and 90 % confidence level based on non-central “t” distribution was also worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test.

**Table 1: Upper fiducial limit of CV % for different disciplines of Maize crop**

Discipline	No. of expt.	CV %	U L		Range		CV % >16.45	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Agronomy</b>	183	13.23	22.23	18.14	9.00	4.91	33	0.18
<b>Entomology</b>	118	12.09	15.04	14.30	2.95	2.21	25	0.21
<b>Pathology</b>	24	10.47	13.48	12.71	3.01	2.24	4	0.16
<b>Pl. breeding</b>	282	10.74	13.53	12.83	2.80	2.10	44	0.15
<b>Average</b>		<b>11.74</b>	<b>16.45</b>	<b>14.71</b>				

**Table 2: Upper fiducial limit of CV % for different design of Maize crop**

Design	No. of expt.	CV %	U L		Range		CV % >16.45	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>FRBD</b>	24	14.81	19.29	18.11	4.49	3.31	5	0.20
<b>RBD</b>	530	11.39	16.31	14.44	4.92	3.05	86	0.16
<b>Split Plot</b>	53	13.83	16.52	15.88	2.70	2.05	15	0.28
<b>Average</b>		<b>11.74</b>	<b>16.45</b>	<b>14.71</b>				

**Table 3: Upper fiducial limit of CV % for different treatments of Maize crop**

Treatments	No. of expt.	CV %	U L		Range		CV % >16.45	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Up to 6</b>	52	9.24	12.88	11.90	3.64	2.66	4	0.07
<b>6-10</b>	200	10.75	14.26	13.35	3.50	2.60	28	0.14

<b>11-15</b>	128	13.81	25.32	19.82	11.51	6.01	22	0.17
<b>16-20</b>	133	12.09	14.51	13.93	2.43	1.85	34	0.25
<b>21-25</b>	35	13.33	15.80	15.22	2.48	1.89	9	0.25
<b>26-30</b>	14	9.81	11.31	10.96	1.50	1.15	3	0.21
<b>&gt;30</b>	45	11.48	12.86	12.55	1.38	1.07	6	0.13
<b>Average</b>		<b>11.74</b>	<b>16.45</b>	<b>14.71</b>				

**Table 4: Upper fiducial limit of CV % for different plot size of Maize crop**

Plot size (m <sup>2</sup> )	No. of expt.	CV %	U L		Range		CV % >16.45	
			(0.05)	(0.10)	(0.05)	(0.10)	No.of expt.	Proportion
<b>&lt;3</b>	24	16.91	21.26	20.13	4.35	3.23	5	0.21
<b>3-6</b>	116	11.20	13.77	13.14	2.57	1.94	18	0.15
<b>6-9</b>	69	13.88	16.87	16.14	2.99	2.26	28	0.40
<b>9-12</b>	72	9.81	12.63	11.92	2.83	2.11	12	0.16
<b>12-15</b>	122	11.04	14.24	13.42	3.20	2.39	18	0.14
<b>15-18</b>	47	13.66	16.62	15.89	2.96	2.24	15	0.31
<b>18-21</b>	116	9.85	12.71	11.98	2.87	2.14	5	0.04
<b>21-24</b>	19	21.78	28.93	27.47	5.38	4.69	2	0.10
<b>&gt;24</b>	22	9.72	12.29	11.63	2.57	1.91	3	0.13
<b>Average</b>		<b>11.74</b>	<b>16.45</b>	<b>14.71</b>				

**Table 5: Upper fiducial limit of CV % for different replications of Maize crop**

Replication	No. of expt.	CV %	UL		Range		No.of expts.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
<b>3</b>	52	11.48	14.31	13.61	2.84	2.13	9	0.17
<b>4</b>	415	11.97	17.45	15.27	5.49	3.30	74	0.18
<b>5</b>	129	10.98	13.98	13.23	3.00	2.25	19	0.15
<b>7</b>	11	13.44	17.43	16.41	3.99	2.98	4	0.36
<b>Average</b>		<b>11.74</b>	<b>16.45</b>	<b>14.71</b>				

**Table 6: The average upper fiducial limit and yardstick for CV % for the experiments of Maize crop**

Name of Crop	No. of experiments	Mean CV %	Upper fiducial limit of CV %		Overall yardstick of CV%
			0.95	0.90	
Maize	607	11.74	16.45	14.71	17%

**Table 7: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
1-5	66	65	01	0.02
5-10	232	217	15	0.07
10-15	167	129	38	0.29
15-20	92	71	21	0.30
20-25	35	25	10	0.40
25-30	7	6	1	0.17
> 30	8	4	4	1.00
<b>Total</b>	607	517	90	0.17

#### **Recommendation for scientific community**

The yard stick of CV% for accepting the results of Maize crop experiment conducted at Main Maize Research Station, Godhra is 17 per cent for yield character.

### 1.3 RICE

Yield data of **1810** experiments conducted on Rice crop during the period 2005-06 to 2019-20 have been used to work out fiducial limits and yardstick of CV % for accepting or rejecting the results of Rice crop. The upper fiducial limits at 95 % and 90 % confidence level based on non-central “t” distribution was also worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test.

**Table 1: Upper fiducial limit of CV % for different disciplines of rice crop**

Discipline	No. of expt.	CV %	U L		Range		CV % >13.56	
			(0.05)	(0.10)	(0.05)	(0.10)	No.of expt.	Proportion
<b>Agronomy</b>	157	10.16	12.30	11.78	2.14	1.62	24	0.15
<b>Entomology</b>	36	10.16	13.23	12.44	3.07	2.28	9	0.25
<b>Pathology</b>	26	6.62	8.52	8.04	1.90	1.42	1	0.04
<b>Pl. breeding</b>	1591	11.17	13.78	13.14	2.61	1.96	411	0.26
<b>Average</b>		<b>11.00</b>	<b>13.56</b>	<b>12.93</b>				

**Table 2: Upper fiducial limit of CV % for different design of rice crop**

Design	No. of expt.	CV %	U L		Range		CV % >13.56	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>FRBD</b>	13	9.40	11.81	11.20	2.40	1.80	2	0.15
<b>RBD</b>	1683	11.05	13.66	13.01	2.61	1.97	424	0.25
<b>Split Plot</b>	114	10.47	12.39	11.94	1.92	1.47	19	0.17
<b>Average</b>		<b>11.00</b>	<b>13.56</b>	<b>12.93</b>				

**Table 3: Upper fiducial limit of CV % for different treatments of rice crop**

Treatments	No. of expt.	CV %	U L		Range		CV % >13.56	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Up to 6</b>	13	10.72	14.73	13.66	4.01	2.94	4	0.31
<b>6-10</b>	249	9.66	12.94	12.08	3.28	2.42	33	0.13
<b>11-15</b>	634	10.83	13.63	12.94	2.80	2.11	136	0.21

<b>16-20</b>	379	11.42	13.95	13.34	2.53	1.92	105	0.28
<b>21-25</b>	209	11.13	13.36	12.83	2.23	1.70	62	0.30
<b>26-30</b>	110	10.56	12.42	11.98	1.86	1.42	23	0.21
<b>&gt;30</b>	216	12.41	14.13	13.74	1.73	1.33	82	0.38
<b>Average</b>		<b>11.00</b>	<b>13.56</b>	<b>12.93</b>				

**Table 4: Upper fiducial limit of CV % for different plot size of rice crop**

Plot size (m <sup>2</sup> )	No. of expt.	CV %	U L		Range		CV % >13.56	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>&lt;3</b>	41	12.96	15.17	14.64	2.22	1.69	15	0.37
<b>3-6</b>	365	12.15	15.01	14.30	2.86	2.15	123	0.34
<b>6-9</b>	580	11.77	14.53	13.85	2.76	2.08	169	0.29
<b>9-12</b>	693	9.82	12.07	11.52	2.25	1.70	110	0.16
<b>12-15</b>	50	9.68	12.32	11.66	2.64	1.97	9	0.18
<b>15-18</b>	69	10.70	13.52	12.81	2.81	2.11	18	0.26
<b>18-21</b>	9	8.27	10.19	9.71	1.92	1.44	1	0.11
<b>21-24</b>	1	5.84	7.29	6.94	1.45	1.10	0	0.00
<b>&gt;24</b>	2	4.61	5.65	5.40	1.04	0.79	0	0.00
<b>Average</b>		<b>11.00</b>	<b>13.56</b>	<b>12.93</b>				

**Table 5: Upper fiducial limit of CV % for different replications of rice crop**

Replication	No. of expt.	CV %	U L		Range		No. of expts.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
<b>2</b>	704	11.33	14.09	13.40	2.76	2.07	202	0.29
<b>3</b>	972	11.07	13.56	12.96	2.50	1.89	225	0.23
<b>4</b>	121	8.70	10.67	10.19	1.97	1.49	17	0.14
<b>6</b>	11	9.79	12.56	11.86	2.76	2.06	1	0.09
<b>8</b>	2	7.16	9.10	8.61	1.94	1.44	0	0.00
<b>Average</b>		<b>11.00</b>	<b>13.56</b>	<b>12.93</b>				

**Table 6: The average upper fiducial limit and yardstick for CV % for the experiments of rice crop**

Name of Crop	No. of experiments	Mean CV %	Upper fiducial limit of CV %		Overall yardstick of CV%
			0.95	0.90	
Rice	1810	11.00	13.56	12.93	14%

**Table 7: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
<5	152	150	2	0.01
5-8	371	363	5	0.01
8-11	517	494	20	0.04
11-14	375	357	18	0.05
14-17	230	213	17	0.08
17-20	83	68	13	0.19
20-23	22	20	2	0.10
23-26	26	20	6	0.30
26-29	14	12	2	0.17
29-32	3	1	2	2.00
32-35	5	5	0	0.00
35-38	4	2	2	1.00
38-41	3	2	1	0.50
41-44	1	0	1	0.00
44-47	0	0	0	0.00
47-50	1	1	0	0.00
> 50	3	1	2	2.00
<b>Total</b>	<b>1810</b>	<b>1709</b>	<b>93</b>	<b>0.05</b>

**Recommendation for scientific community**

The yard stick of CV% for accepting the results of rice crop experiment conducted at Main Rice Research Station, Nawagam is 14 per cent for yield character.

## 1.4 TOBACCO

Yield data of 548 experiments conducted on Tobacco crop during the period 2003-04 to 2019-20 have been used to work out fiducial limits and yardstick of CV % for accepting or rejecting the results of Tobacco crop. The upper fiducial limits at 95 % and 90 % confidence level based on non-central “t” distribution was also worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test.

**Table 1: Upper fiducial limit of CV % for different disciplines of tobacco crop**

Discipline	No. of expt.	CV %	U L		Range		CV % >14.76	
			(0.05)	(0.10)	(0.05)	(0.10)	No.of expt.	Proportion
<b>Agronomy</b>	104	11.64	14.38	13.71	2.74	2.07	26	25.0
<b>Bio-chem</b>	4	13.71	16.68	15.96	2.98	2.25	1	25.0
<b>Pathology</b>	21	18.71	24.94	23.28	6.23	4.57	13	61.9
<b>Pl. breeding</b>	393	11.40	14.51	13.72	3.11	2.32	56	14.2
<b>Pl. Physio.</b>	22	8.98	11.05	10.54	2.07	1.56	0	0.0
<b>Soil Chem</b>	4	12.53	15.17	14.53	2.56	2.01	1	25.0
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				

**Table 2: Upper fiducial limit of CV % for different design of tobacco crop**

Design	No. of expt.	CV %	U L		Range		CV % >14.76	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>FRBD2</b>	28	12.26	15.19	14.47	2.93	2.21	8	28.5
<b>FRBD3</b>	13	14.33	17.22	16.53	2.89	2.20	5	38.5
<b>RBD</b>	428	11.46	14.70	13.88	3.24	2.42	65	15.2
<b>Split Plot11</b>	76	12.01	14.49	13.89	2.47	1.88	18	23.7
<b>Split Plot111</b>	2	12.80	15.72	14.99	2.92	2.19	0	0.0
<b>Split Plot12</b>	1	15.20	17.56	17.02	2.36	1.82	1	100.0
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				



**Table 3: Upper fiducial limit of CV % for different treatments of tobacco crop**

Treatments	No. of expt.	CV %	U L		Range		CV % >14.76	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
Up to 5	18	15.54	21.72	20.04	6.18	4.49	6	33.3
6-10	288	11.25	14.64	13.77	3.39	2.52	43	15.0
11-15	124	11.32	14.02	13.36	2.70	2.04	24	19.4
16-20	103	12.29	14.72	14.14	2.42	1.84	20	19.4
21-25	13	12.99	15.20	14.68	2.21	1.69	3	23.1
26-30	2	14.10	16.28	15.77	2.18	1.67	1	50.0
>30	0	0	0	0	0	0	0	0.0
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				

**Table 4: Upper fiducial limit of CV % for different plot size of tobacco crop**

Plot size (m <sup>2</sup> )	No. of expt.	CV %	U L		Range		CV % >14.76	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<3	0	0	0	0	0	0	0	0
3-6	0	0	0	0	0	0	0	0
6-9	99	13.47	17.17	16.23	3.70	2.76	32	33.3
9-12	114	11.11	14.11	13.35	2.99	2.24	25	22.0
12-15	220	10.94	13.80	13.08	2.86	2.14	16	7.3
15-18	15	18.33	24.87	23.11	6.54	4.77	6	40.0
18-21	6	10.97	13.87	13.15	2.90	2.18	1	16.7
21-24	10	9.12	11.38	10.82	2.26	1.70	1	10.0
>24	84	11.28	14.02	13.35	2.74	2.06	16	19.1
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				

**Table 5: Upper fiducial limit of CV % for different replications of tobacco crop**

Replication	No. of expt.	CV %	U L		Range		No. of expts.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
2	1	11.80	14.59	13.91	2.79	2.11	0	0.0
3	404	11.67	14.73	13.96	3.06	2.29	66	16.4
4	133	11.68	14.95	14.12	3.27	2.44	29	21.8

<b>5</b>	2	12.70	16.79	15.73	4.09	3.03	0	0
<b>6</b>	8	10.39	13.15	12.46	2.77	2.07	2	25.0
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				

**Table 6: Upper fiducial limit of CV % for different locations of tobacco crop**

Location	No. of expt.	CV %	UL		Range		No. of expts.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
<b>ANAND</b>	424	12.17	15.40	14.59	3.23	2.42	78	18.4
<b>DHARMAJ</b>	102	10.88	13.84	13.10	2.97	2.22	18	17.7
<b>LADOL</b>	20	4.51	5.78	5.45	1.27	.95	0	0.0
<b>SANAND</b>	2	13.80	17.31	16.45	3.51	2.65	1	50.0
<b>Average</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>				

**Table 7: The average upper fiducial limit and yardstick for CV % for the experiments of tobacco crop**

Name of Crop	No. of experiments	Mean CV %	Upper fiducial limit of CV %		Overall yardstick of CV%
			0.95	0.90	
<b>Tobacco</b>	<b>548</b>	<b>11.65</b>	<b>14.76</b>	<b>13.98</b>	<b>14.76</b>

**Table 8: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
<b>1-4</b>	14	13	1	.080
<b>4-7</b>	53	51	2	.040
<b>7-10</b>	124	104	20	.190
<b>10-13</b>	128	145	37	.260
<b>13-16</b>	103	76	27	.360
<b>16-19</b>	44	22	22	1.000
<b>19-22</b>	12	5	7	1.400
<b>22-25</b>	9	8	1	.130
<b>25-28</b>	3	0	3	-
<b>28-31</b>	2	0	2	-

<b>31-34</b>	0	0	0	-
<b>34-37</b>	0	0	0	-
<b>37-40</b>	0	0	0	-
<b>40-43</b>	1	0	1	-
<b>43-46</b>	0	0	0	-
<b>46-49</b>	0	0	0	-
<b>49-52</b>	1	0	0	-
<b>52-55</b>	0	0	1	-
<b>&gt;55</b>	0	0	0	-
<b>Total</b>	<b>548</b>	<b>424</b>	<b>124</b>	<b>.290</b>

**Recommendation for scientific community**

The yard stick of CV% for accepting the results of tobacco crop experiment is 14.76 *i.e.*, 15 per cent for yield character.

## **1.5 VEGETABLE CROPS**

Yield data of 26 years of 2713 experiments conducted on vegetable crops during the period 1996-97 to 2021-22 have been used to work out fiducial limits and yardstick of CV% for accepting or rejecting the results of Vegetable crops. The upper fiducial limits at 95% and 90% confidence level based on non-central “t” distribution was also worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test

**Table 1: Upper fiducial limit of CV% for different disciplines of Vegetable crops**

Discipline	No. of expt.	CV%	U L		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Agronomy</b>	41	13.20	13.28	13.26	0.08	0.06	11	26.83
<b>Ento</b>	111	14.56	14.56	14.56	0.00	0.00	34	30.63
<b>Pl. breeding</b>	2561	14.70	16.87	16.31	2.17	1.61	664	25.93
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 2: Upper fiducial limit of CV% for different design of Vegetable crops**

Design	No. of expt.	CV%	U L		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>CRD</b>	14	13.32	13.32	13.32	0.000	0.000	2	14.29
<b>RBD</b>	2684	14.70	16.77	16.23	2.07	1.54	706	26.30
<b>SPLIT PLOT</b>	5	9.77	10.45	10.29	0.69	0.52	1	20.00
<b>STRIP</b>	10	11.89	12.58	12.41	0.70	0.53	0	0
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 3: Upper fiducial limit of CV% for different treatments of Vegetable crops**

Treatments	No. of expt.	CV%	U L		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
Up to 6	108	15.51	20.51	19.10	5.00	3.59	34	31.48
6-10	1511	14.59	16.94	16.33	2.35	1.75	380	25.15
11-15	777	14.16	15.46	15.14	1.31	0.98	186	23.94
16-20	224	15.02	16.22	15.94	1.20	0.91	64	28.57
21-25	42	17.40	19.03	18.64	1.64	1.25	17	40.48
26-30	31	19.85	21.91	21.43	2.06	1.58	17	54.84
>30	20	18.86	21.45	20.85	2.59	1.99	11	55.00
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 4: Upper fiducial limit of CV% for different plot size of Vegetable crops**

Plot size (m <sup>2</sup> )	No. of expt.	CV%	U L		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<3	99	15.22	15.33	15.19	0.11	0.03	23	23.23
3-6	682	14.82	16.38	15.96	1.56	1.13	191	28.00
6-9	567	14.84	16.62	16.11	1.78	1.27	160	28.22
9-12	177	14.99	17.12	16.43	2.13	1.44	59	33.33
12-15	378	13.40	14.79	14.43	1.40	1.04	70	18.52
15-18	382	15.36	18.57	17.68	3.21	2.32	122	31.94
18-21	289	14.38	16.16	15.70	1.77	1.31	64	22.14
21-24	43	13.32	15.48	14.64	2.16	1.32	11	25.58
>24	96	15.19	17.29	16.54	2.10	1.35	30	31.25
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 5: Upper fiducial limit of CV% for different replications of Vegetable crops**

Replication	No. of expt.	CV%	UL		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
2	91	16.98	19.25	18.65	2.27	1.67	36	39.56

<b>3</b>	2392	14.43	16.33	15.84	1.89	1.41	589	24.62
<b>4</b>	180	15.97	19.88	18.87	3.91	2.90	65	36.11
<b>5</b>	16	15.26	16.33	16.06	1.07	0.80	5	31.25
<b>6</b>	34	18.02	21.28	20.46	3.26	2.44	14	41.17
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 6: Upper fiducial limit of CV% for different locations of Vegetable crops**

Location	No. of expt.	CV%	UL		Range		CV% >16.72	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>ANAND</b>	1549	15.12	16.92	16.54	1.80	1.33	421	27.17
<b>BHARUCH</b>	9	14.37	18.35	17.36	3.98	2.99	2	22.22
<b>DANGS</b>	1	4.71	4.71	4.71	0.00	0.00	0	0
<b>DEESA</b>	36	18.47	20.63	20.08	2.16	1.61	15	41.67
<b>DHARI</b>	8	15.84	20.67	19.44	4.83	3.59	3	37.50
<b>JAGUDAN</b>	90	14.10	14.10	14.10	0.00	0.00	28	31.11
<b>JUNAGADH</b>	567	13.86	16.67	15.95	2.81	2.09	120	21.16
<b>LADOL</b>	72	13.95	15.44	15.06	1.49	1.11	21	29.17
<b>NAVSARI</b>	179	14.75	16.91	16.36	2.16	1.60	55	30.73
<b>SK NAGAR</b>	97	13.88	17.42	16.51	3.54	2.62	29	29.90
<b>THASARA</b>	19	11.53	11.53	11.53	0.00	0.00	1	5.26
<b>WAGHAI</b>	52	11.60	13.00	12.64	1.40	1.04	4	7.69
<b>OTHERS</b>	34	15.13	18.99	18.01	3.85	2.88	10	29.41
<b>Average</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>				

**Table 7: The average upper fiducial limit and yardstick for CV% for the experiments of Vegetable crops**

Name of Crop	No. of experiments	Mean CV%	Upper fiducial limit of CV%		Overall yardstick of CV%
			0.95	0.90	
<b>Vegetable Crops</b>	<b>2713</b>	<b>14.67</b>	<b>16.72</b>	<b>16.19</b>	<b>16.72</b>

**Table 8: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
1-6	68	66	2	0.030
6-11	689	653	36	0.055
11-16	1152	1056	96	0.091
16-21	464	372	92	0.247
21-26	197	143	54	0.380
26-31	67	46	21	0.460
31-36	39	24	15	0.630
36-41	16	9	7	0.780
41-46	7	2	5	2.500
46-51	1	1	0	0.000
51-56	6	2	4	2.000
56-61	1	0	1	-
61-66	4	0	4	-
66-71	0	0	0	-
71-76	1	1	0	0.000
76-81	0	0	0	-
81-86	0	0	0	-
86-91	1	1	0	0.000
<b>Total</b>	<b>2713</b>	<b>2376</b>	<b>337</b>	<b>0.14</b>

**Recommendation for scientific community**

The yard stick of CV% for accepting the results of the vegetable crops experiment is now recommended as 16.72, *i.e.* 17 per cent for yield character in place of our previous recommendation of 17.73 per cent.

## 1.6 FORAGE CROPS

Yield data of 19 years of 845 experiments conducted on Forage crops during the period 2005 to 2023 have been used to work out fiducial limits and yardstick of CV% for accepting or rejecting the results of Forage crops. The upper fiducial limits at 95% and 90% confidence level based on non-central “t” distribution were also worked out for yield character. The yardstick of CV% of field experiments was established on the basis of overall average upper fiducial limit of CV% of each experiment and significance of treatment differences by F test.

**Table 1: Upper fiducial limit of CV% for different disciplines of Forage crops**

Discipline	No. of expt.	CV%	U L		Range		CV% >13.50	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Agronomy</b>	130	9.51	12.40	11.55	2.88	2.04	24	18.46
<b>Bio-Chem</b>	48	8.29	10.47	9.93	2.18	1.64	6	12.50
<b>Ento</b>	15	10.67	14.03	13.16	3.36	2.50	8	53.33
<b>PBG</b>	652	10.70	13.94	13.11	3.23	2.41	137	21.01
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 2: Upper fiducial limit of CV% for different design of Forage crops**

Design	No. of expt.	CV%	U L		Range		CV% >13.50	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>CRD</b>	1	16.00	19.40	18.57	3.40	2.57	1	100.0
<b>RBD</b>	813	10.38	13.54	12.71	3.16	2.34	169	20.78
<b>SPLIT PLOT</b>	31	10.32	12.38	11.89	2.06	1.57	5	16.13
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 3: Upper fiducial limit of CV% for different treatments of Forage crops**

Treatments	No. of expt.	CV%	U L		Range		CV% >13.50	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<b>Up to 6</b>	55	12.04	18.13	16.24	6.08	4.20	16	29.09



<b>6-10</b>	499	9.96	13.17	12.35	3.21	2.38	94	18.84
<b>11-15</b>	194	9.99	12.38	11.80	2.40	1.81	37	19.07
<b>16-20</b>	62	12.46	15.09	14.46	2.64	2.00	19	30.65
<b>21-25</b>	18	13.60	16.08	15.49	2.49	1.90	4	22.22
<b>26-30</b>	8	10.34	12.01	11.62	1.68	1.29	2	25.00
<b>&gt;30</b>	9	11.33	12.87	12.51	1.54	1.18	3	33.33
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 4: Upper fiducial limit of CV% for different plot size of Forage crops**

Plot size (m <sup>2</sup> )	No. of expt.	CV%	U L		Range		CV% >13.50	
			(0.05)	(0.10)	(0.05)	(0.10)	No. of expt.	Proportion
<3	2	15.60	16.96	16.66	1.36	1.05	2	100.0
3-6	25	15.34	18.50	17.74	3.16	2.40	11	44.00
6-9	170	10.70	13.77	12.99	3.07	2.29	34	20.00
9-12	166	9.92	12.62	11.95	2.70	2.03	27	16.27
12-15	414	10.27	13.58	12.70	3.32	2.43	87	21.01
15-18	33	9.51	12.71	11.83	3.19	2.31	8	24.24
18-21	19	10.03	13.38	12.52	3.35	2.49	4	21.05
21-24	5	8.56	10.76	10.21	2.20	1.65	0	0
>24	11	8.78	11.56	10.85	2.78	2.07	2	18.18
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 5: Upper fiducial limit of CV% for different replications of Forage crops**

Replication	No. of expt.	CV%	U L		Range		No. of expt.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
2	23	12.07	14.82	14.14	2.75	2.07	8	34.78
3	565	10.24	13.23	12.47	2.99	2.23	111	19.65
4	232	10.62	14.06	13.12	3.44	2.50	49	21.12
5	25	9.80	13.24	12.34	3.44	2.53	7	28.00
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 6: Upper fiducial limit of CV% for different locations of Forage crops**

Location	No. of expt.	CV%	UL		Range		No. of expt.	Proportion
			(0.05)	(0.10)	(0.05)	(0.10)		
ANAND	776	10.06	13.08	12.30	3.02	2.23	150	19.33
ARNEJ	10	9.94	13.06	12.26	3.12	2.33	2	20.00
DEESA	2	6.00	7.49	7.12	1.49	1.11	0	0
DEROL	2	7.38	9.81	9.21	2.42	1.82	0	0
DHANDHUKA	12	10.60	13.84	13.01	3.24	2.41	2	16.67
DHARI	7	25.93	34.35	32.14	8.42	6.21	5	71.43
KHAPAT	1	3.20	4.10	3.87	0.90	0.67	0	0
KHDEBRAMA	1	8.90	11.41	10.78	2.51	1.88	0	0
NAVSARI	2	10.50	13.77	12.91	3.27	2.41	0	0
RADHANPUR	1	27.90	36.44	34.27	8.54	6.37	1	100.0
S K NAGAR	6	15.88	21.17	19.77	5.28	3.89	3	50.00
SANSOLI	2	8.66	10.90	10.34	2.24	1.68	0	0
TARGHADIA	1	5.60	7.17	6.78	1.57	1.18	0	0
VALLBHIPUR	1	18.60	24.02	22.65	5.42	4.05	1	100.0
VIRAMGAM	21	15.84	20.32	19.19	4.48	3.35	11	52.38
<b>Average</b>	<b>845</b>	<b>10.38</b>	<b>13.50</b>	<b>12.69</b>				

**Table 7: The average upper fiducial limit and yardstick for CV% for the experiments of Forage crops**

Name of Crop	No. of experiments	Mean CV%	Upper fiducial limit of CV%		Overall yardstick of CV%
			0.95	0.90	
Forage Crops	845	10.38	13.50	12.69	13.50

**Table 8: Power of F-test as influence by CV%**

Classes CV%	No. of experiments	F-test		
		Significant	Non-Significant	Ratio
<5	81	63	18	0.29
5-8	253	218	35	0.16
8-11	224	185	39	0.21

<b>11-14</b>	130	104	26	0.25
<b>14-17</b>	93	85	8	0.09
<b>17-20</b>	29	24	5	0.21
<b>20-23</b>	9	5	4	0.80
<b>23-26</b>	9	8	1	0.13
<b>26-29</b>	3	2	1	0.50
<b>29-32</b>	3	2	1	0.50
<b>32-35</b>	1	1	0	0.00
<b>35-38</b>	0	0	0	0.00
<b>38-41</b>	2	2	0	0.00
<b>41-44</b>	0	0	0	0.00
<b>44-47</b>	1	0	1	-
<b>47-50</b>	1	0	1	-
<b>&gt;50</b>	6	5	1	0.20
<b>Total</b>	<b>845</b>	<b>704</b>	<b>141</b>	<b>0.20</b>

#### **Recommendation for scientific community**

The yard stick of CV% for accepting the results of the Forage crops experiment is now recommended as 13.50, *i.e.* 14 per cent for yield character which is similar to our previous recommendations.

## **2. Research Recommendations**

### **Year 2019**

The yard stick of CV% for accepting the results of Sugarcane crop experiments is 11 per cent for yield character.

### **Year 2020**

The yard stick of CV% for accepting the results of Maize crop experiments conducted at Main Maize Research Station, Godhra is 17 per cent for yield character.

### **Year 2021**

The yard stick of CV% for accepting the results of rice crop experiment conducted at Main Rice Research Station, Nawagam is **14** per cent for yield character.

### **Year 2022**

The yard stick of CV% for accepting the results of tobacco crop experiment is 14.76 *i.e.*, 15 per cent for yield character.

### **Year 2024**

1. The yard stick of CV% for accepting the results of the vegetable crops experiment is now recommended as 16.72, *i.e.*, 17 per cent for yield character in place of our previous recommendation of 17.73 per cent.
2. The yard stick of CV% for accepting the results of the Forage crops experiment is now recommended as 13.50, *i.e.*, 14 per cent for yield character which is similar to our previous recommendation of 13.94 per cent.