

A SCALE TO MEASURE THE SCIENTIFIC TEMPER OF FARM WOMEN**Sanyogita Dhanwal¹ and Vandana Verma²**

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ABSTRACT

The scientific temper unifies our mental processes, social interactions, and manner of life. The primary goal of this study work is to examine scientific positioning on advanced technologies. A person who is scientifically literate uses their extensive knowledge, which includes comprehension of scientific concepts and principles, theories, and procedures, to make well-informed decisions in the context of science and technology. In the time of scientific and technical advancement. Women's material and nonmaterial development has been drastically altered by science. It is now a necessary component of life, without which no one could lead a comfortable life. Therefore, a new intellectual temper known as the scientific temper has been fostered by science and technology. Out of total 50 statements, 28 statements were selected to measure the scientific temper of women regarding the agriculture, household and livestock technologies. Coefficient of correlation was 0.769.

Keywords: scientific temper, knowledge, development, farm women

INTRODUCTION

The scientific temper is a guiding principle that cuts across academic fields and enables people to interact with the world meaningfully and intelligently. It acts as a lighthouse, pointing the way to a time when the application of reason and the quest of knowledge would result in a society that is more enlightened and peaceful. Innovations in agriculture and the use of better technologies are essential to raising farming's sustainability and productivity. For successful implementation, it is equally important to comprehend farm women's attitudes and scientific temper towards these advancements. This introduction discusses the idea of a scale intended for this purpose and gives a summary of the importance of assessing farm women's scientific temper in relation to enhanced agricultural technologies.

A scientific temperament is an attitude that one hopes to instill in others so that they apply scientific principles and practises to all aspects of their lives. By utilising the farmers' scientific attitude, it is now possible to meet their requirements and provide a solution to this predicament. Therefore, the purpose of this study was to create and standardize a scale for evaluating farm women scientific temper.

OBJECTIVE

To develop a scale to measure the scientific temper of farm women

METHODOLOGY

A number of scaling techniques are used by social scientists/ researchers to measure socio psychological constructs (such as attitude, perceptions, etc.) in social sciences including extension education. Scientific temper is defined as a person's scientific bent of mind and interest in understanding science and scientific facts. There is need to know how much science does the rural women understand? What are the sources through which they get this information and what is their attitude towards the science? In this study, Likert (1932) technique of summated rating scale was used for construction of scale for measuring scientific temper procedural steps followed are as under.

In this study, a scale was developed by using the method of summated ratings as suggested by Likert (1932), Edwards (1957) and Vinaya et al (2018). A Summated rating scale consists of a set of statements, all of which are considered of approximately equal value, and to each of which subjects respond with degrees of agreement or disagreement carrying different scores.

Steps in construction of scientific temper scale for farm women

The following steps were followed for construction of scale:

I Item selection

Statement that comprised the content area was collected from relevant literature/discussion with experts and researchers own experience.

II Collection and editing of statements

A set of statements were assembled on the

science associated with different technologies from available literature on internet, journals, books, newspaper, journals and subject experts etc. A tentative list of 50 statements were prepared after consulting with the researchers and extension experts.

III Editing the statement

The items and statements were carefully edited according to the fourteen criteria given by Likert (1932), Bird (1940) and Edwards and Kilpatrick (1957). Out of total 50 statements, 44 statements were selected as they were found to be non-ambiguous and non-factual.

Table 1: Relevancy indices of identified items for measuring the scientific temper of respondents regarding improved technologies

Sr. No.	Statement	RP	MRW	MRS
1	Cotton picking bags help in reducing shoulder pain, neck pain, back pain and increase picking efficiency.*	92.5	0.88	2.65
2	Quality crop production is possible through use of science and technology.	87.5	0.79	2.37
3	Use of face mask prevents body to enter harmful particles.*	95	0.88	2.65
4	Cot bag carried more weight than traditional bag also reduce the movements while cotton plucking.*	97.5	0.87	2.62
5	Use of modern technology in farming means save time and energy and reduce fatigue.*	82.5	0.76	2.29
6	Safety gloves are useful in harvesting of guar prevent itchininess in hands with air permeability to avoid the hands from sweating.*	95	0.86	2.60
7	Twin wheel hand hoe weeder is operated in standing posture and easily disturbs the top soil and increases aeration.*	97.5	0.95	2.87
8	Tuberculosis, typhoid, cholera, diarrhea, jaundice and food polluted drinking water.*	90	0.79	2.37
9	Exposed garbage and other water materials are breeding place of flies and mosquitoes which carry the germs of disease*	100	0.94	2.82
10	Improved sickle has fine hand grip which consume low energy and improve working efficiency.*	100	0.96	2.90
11	Burning of dry fields is harmful for soil and crop because it degrades soil quality and environment pollution.*	97.5	0.90	2.72
12	Copper utensils help to maintain healthy bones, vessels, detoxify body and improve immunity. *	100	0.95	2.87
13	Garbage and waste from the house should be deposited in compost pits*	100	0.98	2.95
14	Science and technology are making our life easy, healthy and more comfortable*	100	0.99	2.97
15	New agricultural technologies save time and energy and prevents from diseases i.e. physical injuries, mental stress, asthma, cough etc.	90	0.79	2.37
16	Science and technology are making our life easy, healthy and more comfortable.*	100	0.97	2.92
17	Exposure on carbon mono-oxide is fatigue, headaches, confusion, and dizziness.*	100	0.95	2.87
18	Water filter removes the harmful bacteria, virus and fungi.*	100	0.92	2.77
19	LPG does not produce harmful emission like CO, NOx and higher hydrocarbons.*	97.5	0.93	2.80

Sr. No.	Statement	RP	MRW	MRS
20	Inhaling LPG vapor at high concentration even for a short time can cause asphyxiation, seizures, comas, heart problems and death.*	100	0.93	2.80
21	Smokeless chulha consume less fuel because sufficient air is provided and complete combustion of fuel takes place *	100	0.97	2.92
22	Sanitary pads are harmful because it contains styrene, chloromethane, chloroform and acetone.*	100	0.97	2.92
23	Tuberculosis, typhoid, cholera, diarrhea, jaundice and food poisoning are caused by infected food and polluted drinking water. *	97.5	0.89	2.67
24	Exposed garbage and water are breeding place of flies and mosquitoes which carry the germs.*	97.5	0.85	2.57
25	Burning of dry leaves, papers and waste cause air pollution.*	97.5	0.88	2.65
26	Science and technology helps in reduce manpower in activities.	85	0.73	2.20
27	Electric chaff cutter are energy-efficient, and it saves time and human resources for cutting a large amount of chaff.	90	0.75	2.50
28	The vaccine reduces the risk of complications and mortality following subsequent exposure to an infectious agent.	72.5	0.68	2.15
29	Cotton picking bags reduce drudgery during harvesting of crop and picking of cotton balls.	80	0.75	2.25
30	Face mask help to reduce contamination and human health	83.0	0.74	2.29
31	Cot bag carried more weight than traditional bag also reduce the movements while cotton plucking.	82.5	0.75	2.27
32	Use of refrigerator, air conditioner and perfumes etc. are the major cause for global warming.*	100	0.93	2.80
33	Excessive use of digital technologies may the cause of disease like alzheimer's, brain tumor, heart attack, infertility.*	100	0.96	2.90
34	Environmental friendly technologies reduce carbon dioxide and methane, nitrous oxide, chlorofluorocarbons and ozone gas production. *	100	0.95	2.85
35	Refrigerant and air conditioner release Freon gas (CFC) cause ozone depletion and global warming. *	95	0.90	2.70
36	The optimum refrigerator temperature range for storing fresh food is between 38-40 degrees Fahrenheit.*	100	0.94	2.82
37	Incomplete burning of biomass release carbon mono-oxide gas which reducing the ability of blood to carry oxygen. *	98	0.96	2.91
38	Refrigerant and AC release Freon gas (CFC) cause ozone depletion and global warming.*	100	0.95	2.85
39	Constant exposure to air trapped in a room can lead to headaches, dizziness, eye irritation, throat and skin allergies.	66	0.59	1.92
40	Revolving stand and stool highly significant in reduction of reduces stress and body strain. *	97.5	0.95	2.85
41	Heavy load in dung collection activities can cause musculo-skeletal disorders.*	92	0.89	2.67
42	Dung collector helps in collecting the dung with comfortable standing posture, reduces incidences of low back pain.*	100	0.96	2.90
43	Use of trolley reduction in cervical and lumbar angle deviation.*	98	0.96	2.91
44	Dung scrapper reduces lower back pain due to frequently bending posture.*	100	0.90	2.72

*denotes statements/items selected for further analysis

IV Relevancy test

It was possible that all the collected statements may not be equally relevant in measuring the scientific temper of farm women regarding the improved technologies. As a result, an expert panel evaluated these statements to determine their relevancy and to

their screening for final inclusion in the scale. The judges comprised experts (scientists and researchers) from extension education disciplines of different State Agricultural Universities (SAUs), State Departments and Extension Institutes. The statements were sent to 100 judges with necessary instructions to critically evaluate each statement for its relevancy. The judges

were requested to give their response on a 3 point continuum viz., most relevant, relevant and least relevant, respectively. Out of 100, only 45 responded in the time span of two months, out of which five expert responses were rejected due to incomplete and ambiguity in responses. Their responses were considered for item analysis after the computation of relevancy percentage, mean relevancy weightage and mean relevancy score. Subsequently, items having relevancy percent greater than 70, relevancy weightage greater than 0.70, and mean relevancy score greater or equal to overall mean relevancy score *i.e.* 2.30 were considered for final selection (Raghuvanshi and Ansari, 2019). With the help of this process, in the first stage, 44 statements were sorted (Table 1) which were further rewritten and modified as per the suggestions given by experts.

(a) Relevancy percentage

Relevancy percentage was worked out by summing up the scores of “most relevant” and “relevant” categories, which were converted into percentage.

Relevancy percentage was obtained by the formula:

$$RP = \frac{FS \times 100}{\text{No. of Respondents}}$$

Where,

FS= Frequency score of most relevant and relevant

RP= Relevancy Percentage

(b) Mean Relevancy Weightage (MRW)

Mean relevancy weightage was obtained by the formula:

$$MRW = \frac{MRR \times 3 + RR \times 2 + LRR \times 1}{MPS}$$

Where,

MRR = Most Relevant response

RR = Relevant Response

LRR = Least Relevant response

MPS = Maximum Possible Score (40*3= 120)

(c) Mean Relevancy Score (MRS)

Mean relevancy score was obtained by the following formula:

$$MRS = \frac{MRR \times 3 + RR \times 2 + LRR \times 1}{\text{No. of judges}}$$

Where,

MRR = Most Relevant response

RR = Relevant Response

LRR = Least Relevant response

(V) Item analysis

Analysis of items is important to portray the reliability and validity of identified items (Lal *et al.*, 2014). It helps to categorize the items on the basis of degree to which they can differ the respondents with high and low scientific temper. For this a schedule composed of 34 statements was administered on 20 respondents from the non-sampling area. The responses for the statements were obtained on a five point continuum viz., Strongly agree, Agree, Undecided, Disagree and Strongly disagree with scores of 5, 4, 3, 2 and 1, respectively. For negative statements, the scoring pattern was reversed. The perception score of the respondent was obtained summing up the scores of all statements.

For item analysis, score of each respondent was secured by computing scores of all items. Each respondent's scores were rank in ascending order, and two groups were created by choosing 25.00 per cent of the respondents with the highest scores (the high group) and 25.00 per cent of the respondents with the lowest scores (the low group). Ten respondents with the highest total score and ten respondents with lowest total score from non-sampled area were selected. These two groups provided the criterion groups in terms of evaluating the individual statements as suggested by Edwards (1957).

The critical ratio was calculated by t-test. The ‘t’ value is a measure of the extent to which a given statement differentiates the high group from the low group. The ‘t’ value was calculated by using the formula suggested by Edwards

$$t = \frac{(x_1 - x_2)}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

X_H = mean score on statement for the high group

X_L = mean score on statement for the low group

S_H^2 = variance of the distribution of response of high group to the statement

S_L^2 = variance of the distribution of response of low group to the statement

n_H = number of subjects in the high group;

n_L = number of subjects in the low group

Based on the t values, further 28 statements were finally selected in the scale of scientific temper.

Table 2 below gives the results of analysis of statements and their respective t-values.

(VI) Selection of statements for final scale

The statements having a t-value of 1.75 and above were selected for final scale, the t-value for all statements are shown in Table 2.

Table:2 Experts perception about scientific temper statements analysis and their respective t-values

Sr. No.	Statement	t-value
1	Cotton picking bags help in reducing shoulder pain, neck pain, back pain and increase picking efficiency.	2.55*
2	Use of face mask prevents body to enter harmful particles.	3.86*
3	Cot bag carried more weight than traditional bag also reduce the movements while cotton plucking.	2.17*
4	Safety gloves are useful in harvesting of guar prevent itchiness in hands with air permeability to avoid the hands from sweating.	4.41*
5	Twin wheel hand hoe weeder is operated in standing posture and easily disturbs the top soil and increases aeration.	3.16*
6	Improved sickle has fine hand grip which consume low energy and improve working efficiency.	3.12*
7	Burning of dry fields is harmful for soil and crop because it degrades soil quality and environment pollution.	2.16*
8	Copper utensils help to maintain healthy bones, vessels, detoxify body and improve immunity.	3.00*
9	Exposure on carbon mono-oxide is fatigue, headaches, confusion, and dizziness.	4.41*
10	Water filter removes the harmful bacteria, virus and fungi.	3.37*
11	LPG does not produce harmful emission like CO, NOx and higher hydrocarbons.	2.90*
12	Inhaling LPG vapor at high concentration even for a short time can cause asphyxiation, seizures, comas, heart problems and death.	3.01*
13	Smokeless chulha consume less fuel because sufficient air is provided and complete combustion of fuel takes place	2.86*
14	Sanitary pads are harmful because it contains styrene, chloromethane, chloroform and acetone.	3.75*
15	Tuberculosis, typhoid, cholera, diarrhea, jaundice and food poisoning are caused by infected food and polluted drinking water.	2.20*
16	Exposed garbage and water are breeding place of flies and mosquitoes which carry the germs.	3.24*
17	Burning of dry leaves, papers and waste cause air pollution.	3.46*
18	The easiest way to purify water at home is by boiling	1.69
19	Use of refrigerator, air conditioner and perfumes etc. are the major cause for global warming.	2.82*
20	Excessive use of digital technologies may the cause of disease like alzheimer's, brain tumor, heart attack, infertility.	3.49*
21	Environmental friendly technologies reduce carbon dioxide and methane, nitrous oxide, chlorofluorocarbons and ozone gas production.	4.32*
22	Refrigerant and AC release Freon gas (CFC) cause ozone depletion and global warming.	3.79*

Sr. No.	Statement	t-value
23	Freeze, air conditioner and deodorants increase the production of harmful gas.	2.43*
24	Incomplete burning of biomass release carbon mono-oxide gas which reducing the ability of blood to carry oxygen.	2.31*
25	Profitable agricultural production is possible through intervention of science and technology.	0.398
26	Adoption of new scientific agricultural technologies is problematic process.	0.778
27	Revolving stand and stool highly significant in reduction of reduces stress and strain	4.32*
28	Heavy load in dung collection activities can cause musculo-skeletal disorders.	2.84*
29	Dung collector helps in collecting the dung with comfortable standing posture, reduces incidences of low back pain.	3.05*
30	Use of trolley reduction in cervical and lumbar angle deviation.	3.65*
31	Dung scrapper reduces lower back pain due to frequently bending posture.	3.03*

*selected statement

After computing “t” value for all the items, 28 statements with highest “t” value equal to or greater than 1.75 were selected. The thumb rule of rejecting the items with t-value ≤ 1.75 was followed. As per the thumb rule, selection of items (i.e. statements) to be retained in the scale was based on the highest discriminating values, besides eliminating those with poor discriminating ability and questionable validity.

Thus ---- statements were retained in the final scale based on the following criteria:

- The ‘t’ value should be more than 1.75
- The statement should present a new idea i.e., the idea not overlapping with that expressed with other statement
- The statement should be simply worded and brief.

(VII) Standardization of the scale

The validity and reliability was ascertained for standardization of the scale. The validity was confirmed by content validity and criterion validity (Priyadarshani, 2021).

(a) Validity: The content validity of the scale was analyzed. The representativeness or sampling effectiveness of a measuring instrument’s content, substance, subject matter and topics is known as content validity. As the content of the scale thoroughly covered the scientific temper of technologies through literature review and experts’ opinion, it was assumed that present scale satisfies the content validity. Thus, scale value difference for all the statements has a high

discriminating value and it seems reasonable to accept the scale as a valid measurement.

(b) Reliability: The Cronbach’s alpha method for testing reliability was calculated. The scale was split into two equal halves on the basis of odd and even number of items and administered to 20 experts from non-sampling area. Thus, two sets of scores were obtained as shown in Table 3. The alpha value for set 1 i.e. odd items found to be 0.823 and for even items 0.869, which reflects high reliability. The Pearson’s product moment correlation coefficient was calculated 0.769 and this was further confirmed by using spearman’s brown formula ($r = 0.816$) at 0.05 level of significance. The test is reliable to measure the scientific temper of respondents about improved technologies.

Table 3 : Reliability statistics between selected items

Cronbach’s Alpha Value	Set 1 (Odd items)	0.823
	Set 2 (Even items)	0.869
Correlation between items	0.769**	
Spearman-Brown Coefficient	0.816**	

The final scale which would measure the scientific temper of farm women consisted of 28 items. The scale can be administered on a three point scale ranging from three for agree, two for neutral, one for disagree.

(VIII) Final Administration –

The finally selected statements of the scale were randomly arranged and incorporated in the final

format of the interview schedule for the farm women. below:

Statements selected for inclusion in the final scale given

Table:5 Scale to measure the scientific temper related to agricultural technologies

Sr. No.	Statement	Agree	Neutral	Disagree
(A) Agricultural technologies				
1	Cotton picking bags help in reducing shoulder pain, neck pain, back pain and increase picking efficiency.			
2	Use of face mask prevents body to enter harmful particles.			
3	Cot bag carried more weight than traditional bag also reduce the movements while cotton plucking.			
4	Improved sickle has fine hand grip which consume low energy and improve working efficiency.			
5	Safety gloves are useful in harvesting of guar prevent itchininess in hands with air permeability to avoid the hands from sweating.			
6	Twin wheel hand hoe weeder is operated in standing posture and easily disturbs the top soil and increases aeration.			
(B) Household technologies				
7	Burning of fields is harmful for soil and crop because it degrades soil quality and environmental pollution.			
	Household technologies			
8	Copper utensils help to maintain healthy bones, vessels, detoxify body and improve immunity.			
9	Environmental friendly technologies reduce carbon dioxide and methane, nitrous oxide, chlorofluorocarbons and ozone gas production.			
10	Refrigerant and AC release Freon gas (CFC) cause ozone depletion and global warming.			
11	Freeze, air conditioner and deodorants increase the production of harmful gas.			
12	Incomplete burning of biomass release carbon mono-oxide gas which reducing the ability of blood to carry oxygen.			
13	Exposure on carbon mono-oxide is fatigue, headaches, confusion, and dizziness.			
14	Water filter removes the harmful bacteria, virus and fungi.			
15	LPG does not produce harmful emission like CO, NOx and higher hydrocarbons.			
16	Inhaling LPG vapor at high concentration even for a short time can cause asphyxiation, seizures, comas, heart problems and death.			
17	Smokeless chulha consume less fuel because sufficient air is provided and complete combustion of fuel takes place			
18	Sanitary pads are harmful because it contains styrene, chloromethane, chloroform and acetone.			
19	Tuberculosis, typhoid, cholera, diarrhea, jaundice and food poisoning are caused by infected food and polluted drinking water.			
20	Exposed garbage and water are breeding place of flies and mosquitoes which carry the germs.			
21	Burning of dry leaves, papers and waste cause air pollution.			
22	Use of refrigerator, air conditioner and perfumes etc. are the major cause for global warming.			
23	Excessive use of digital technologies may the cause of disease like alzheimer's, brain tumor, heart attack, infertility.			
(C) Livestock technologies				
24	Revolving milking stand with stool highly significant in reduction of stress and strain in body			
25	Heavy load in dung collection activities can cause musculo-skeletal disorders			

Sr. No.	Statement	Agree	Neutral	Disagree
26	Dung collector helps in collecting the dung with comfortable standing posture, reduces incidences of low back pain			
27	Use of trolley reduction in cervical and lumbar angle deviation			
28	Dung scrapper reduces lower back pain due to frequently bending posture			

RESULTS

The final scale consisted of 20 statements as given in Table 5. The statements have been categorized according to their (i) agricultural technologies, (ii) household technologies, and (iii) livestock technologies. The response to each of the scale statements was on a three-point continuum rating from agree to disagree. The responses were scored as agree-3, neutral-2, disagree-1 for favorable statements and reverse for unfavorable statement/negative statements. The perception score of each respondent can be calculated by adding up the scores obtained by her on all the items. The perception score on this scale ranges from minimum 28 to a maximum of 84. Based on their scores respondents were divided into three categories viz. high, medium and low. The higher score indicates that the respondent had more scientific temper about the improved technologies. The results are inline with the findings of Patel et al. (2022), Patel et al. (2022), Chandravadia et al. (2021) and Bhati, et al. (2020).

DISCUSSION AND CONCLUSION

An knowledge of how people or societies view, approach, and interact with scientific ideas can be gained through the use of a scientific temper scale. It reveals the complexities of learning, critical thinking, and being willing to accepting evidence-based reasoning. Researchers and decision-makers can learn vital information about the forces forming intellectual landscapes by using this lens. The scientific temper scale is a compass that directs cultures towards intellectual advancement and enlightenment, not only a means of measurement. The scale becomes an instrument of empowerment, guiding people and communities towards a future where scientific temper is a driving force for good change and societal growth by cultivating a culture where curiosity, critical thinking, and ethical considerations merge. So it can be said that the scales under study were observed highly stable or dependable for measurement and out of 50 statements

related to scientific temper, 28 statements were found to be significant in scientific temper to constitute the scale for scientific temperament of farm women. It highlights the revolutionary potential of an approach based on critical inquiry and evidence-based thinking, opening the door to a society that is more enlightened, knowledgeable, and forward-thinking. The development of scientific temper is still a critical and long-term objective for a brighter future as communities struggle with complicated concerns.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest

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