

# Teacher Beliefs About Sustainable Agriculture: A Self-made Measurement Scale

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## Abstract

The study's purpose was to analyze the validity of the construct of a self-made Alternative-Conventional Agricultural Paradigm scale using the teacher population teaching high school agriculture in the North Central Region of the USA. A random sample of 844 teachers was drawn. Teachers were self-administered questionnaires with 5-point Likert-type scales. Instrument inter-item consistency and item coherence were determined. The relatively high coefficient alpha (.82), mean item total correlation (.40), and unrotated first factors with modest number of items loading on the factor means that the scale has mainly one underlying construct. The teacher population holds consistent views and attitudes about SA constituting an agricultural paradigm. The instrument items are coherent as components of a whole and are related. However, the teacher population did not hold stronger paradigmatic views on the scale as can be expected because of their relatively low mean score item-total correlation and coefficient alpha for the instrument compared to what was found for the scale in the Beus and Dunlap (1991) study. This should be expected because agriculture teachers are not strong adherents of the two agricultural paradigms who can be expected to make extreme and polar scores on the scale. The instrument can therefore be used to preliminarily gauge the paradigmatic orientation of agriculture teachers in the region. Further research with the instrument with known groups supporting the two paradigms is necessary to establish its validity.

**Keywords:** agriculture paradigms, agricultural sustainability, conventional agriculture, conventional agriculture paradigm, dominant social paradigm, sustainable agriculture, sustainable agriculture paradigm, sustainable agriculture scale, sustainability measurement, sustainability scale

## 1. Introduction

According to Beus and Dunlap (1990), sustainable agriculture (SA) emerged in the 1980s as a new paradigm of agriculture distinct from conventional agriculture (CA) based on the dominant Western world view that has elevated progress, growth and faith in science and technology in solving any societal problem above everything else (Jackson-Smith & Buttel, 2003). Consequently much debate about the pros and cons of SA and CA occurred between advocates of the two paradigms of agriculture in the 1980s and beyond. A paradigm is a subset of a belief system and can inform social practices such as farming practices among farmers endorsing SA/CA paradigms. Beus and Dunlap (1991, 1994) developed a scale for Alternative-Conventional Agriculture Paradigm (ACAP) to identify adherence to the two diametrically opposed and polar paradigms. The researchers, Beus and Dunlap (1991), indicated the scale could facilitate a basis of understanding the different positions taken in agricultural debates and possible resolutions of the debates. The scale was also expected to identify the main points of convergence and divergence between proponents and exponents of the two paradigms from relative endorsements of the paradigms (Beus & Dunlap, 1991). Muma, Martin and Shelley (2011) made a conclusion that the position taken by an individual on a particular paradigm on the scale is expected to translate into behavioral practices in agriculture reflecting the particular paradigm endorsed.

One important area that the need for establishing the unidimensionality/internal consistency for the ACAP scale is necessary is in high school agriculture education. Understanding agriculture teacher positions on the scale would illuminate the extent to which the values and beliefs teachers hold about SA/CA can influence their motivation to teach and help students develop positive attitudes towards SA (Rasmussen & Kaltoft, 2003) and

contribute to the goals of SA. This is expected as one's paradigm of agriculture and has effects on their professional knowledge and experience of agriculture and vice versa (Wheeler, 2007). The objective of the study was to assess the construct validity of a self-made ACAP scale using agriculture teacher population of the states in the North Central Region.

The six dimensions of SA/CA used by Beus and Dunlap (1991) in constructing the ACAP scale were distilled from analysis of statements about each paradigm of agriculture made over time by paradigm proponents. The elements were synthesized from the definitions, meanings, structures, policies and practices about agriculture that members of the two camps have advocated for agriculture. Each element has been identified in a pair in which each pair measures polar and opposed beliefs/values about sustainable agriculture and conventional agriculture (Beus & Dunlap, 1992, 1994 cited in Muma, Martin, Shelley, & Holmes, 2010). Muma et al., 2010 stated that differences between proponents and exponents of the diametrically opposed paradigms can be assessed by the extent to which a score on the scale is aligned to each element pair as follows: (1) *independence* versus *dependence*; (2) *centralization* versus *decentralization*; (3) *competition* versus *community*; (4) *exploitation* versus *restraint*; (5) *specialization* or *diversity*; and (6) *domination* or *harmony*. A pair of a dimension of SA or an element is an all or none trait which an individual does not necessarily fit into neatly (Beus & Dunlap, 1990 cited in Muma et al., 2010).

Beus and Dunlap (1991 cited in Muma et al., 2010) validated the scale by matching the expected scores on adherence to SA/CA to farmer/individual organizational affiliation among statewide farmers and members of known groups supporting one or the other of the two paradigms in Washington State, USA such as agricultural chemical dealers. The known groups had relatively stronger polar scores on the instrument compared to the statewide farmers whose scores were in between the two extremes. The instrument achieved an internal consistency defined by a modest mean corrected item-total correlation (.46) and coefficient alpha (.88). The attitudinal variables were assumed to have coherence as interrelated parts of a whole as beliefs in the concept of a paradigm. Endorsement of beliefs about SA among agricultural faculty and students on the one hand (Beus & Dunlap, 1992; Rasmussen & Kaltoft, 2003) and adoption of farming practices among farmers on the other have been validated in a number of studies in Canada (Abaidoo & Dickinson, 2003, 2009), Australia (Rickson, Saffigna & Sanders, 1999), and the USA (Allen & Bernhardt, 1995 cited in Welsh & Rivers, 2011; Beus & Dunlap, 1994 cited in Welsh & Rivers, 2011; Chiappe & Flora, 1998; Petrzelka & Korsching, 1996). All the studies except that of Petrzelka and Korsching (1996) concluded the ACAP scale could be used to delineate for individuals the polar beliefs about agriculture. However, the researchers indicated that some elements of SA/CA were not as strong as the others in achieving this end.

Chiappe and Flora (1998 cited in Muma et al., 2010) affirmed the relevance of the six ACAP scale elements but pointed out a minor controversy that the *normative* elements not as much focused on by researchers who have established existence of the paradigms of agriculture in the ACAP scale applied more to women in SA than to men. This could have important gender implications for research, policy, and education to facilitate SA practice. A major controversy for the scale concerns contention of its unidimensionality or coherence of its elements as parts of an interrelated whole as in the concept of paradigm (Jackson-Smith & Buttel, 2003). The researchers found using varimax factor rotation analysis two sub-scales based on 12 selected ACAP variables they named as 'environmentalism' and 'family-farmer' that predicted a set of SA practices adopted by a sample of farmers in Wisconsin State, USA. The sub-scales only comprised of the ecological and social/structural components of the "ACAP" scale. This finding has weaknesses however; the predictive ability of the sub-scales for farmer practices does not differ fundamentally from the one of the ACAP scale and the two subscales are slightly negatively correlated and cannot therefore predict the same construct (Muma, 2006).

There is a fundamental methodological problem with the studies and especially that of Jackson-Smith and Buttel (2003) mentioned already that attempted to establish the relationship between farmer paradigmatic positions and adopted agricultural practices except those of Beus and Dunlap (1991, 1992, 1994). The theoretically required specification for attitudinal and multiple-act behavioral relationship is to relate summated paradigm variables to summated behavioral (farming practices) variables or individual attitude variables to specific behavioral variables. The requirement for this principle varied among the studies and their results may be in question. Further, there could be a methodological problem in adoption studies and paradigms in that some studies have not used rigorous techniques to classify farmers as sustainable agriculture farmers or not. The issue of variability of farmers' stages of adoption of agricultural practices may necessitate the need to stratify farmers on this variable in studies of agricultural paradigms. This calls into question the accuracy of findings of both the studies which support and those which contradict the Beus and Dunlap (1991, 1994) findings on the ACAP scale.

Dunlap, et al. (2000 cited in Welsh & Rivers, 2011), did address Jackson-Smith's and Buttel's (2003) contention

against the unidimensionality of the scale. Dunlap, et al. indicated that a paradigm scale may not be unidimensional for some diverse populations in developing the New Ecological Paradigm (NEP) scale. NEP has the ecological dimension in the ACAP scale (Welsh & Rivers, 2011). They concluded that when further analysis of the variables of a scale by principal components and reliability analyses result in mainly one major dimension (larger Eigenvalue) and a high corrected item-total correlation and coefficient alpha, then a scale can be regarded as unidimensional. Trobe and Acott (2000) also developed a modified valid NEP scale agreeing with Dunlap et al. (2000).

To the best of our knowledge, no study using the ACAP scale has investigated the construct validity of the ACAP scale using agriculture teacher population in the NCR. Analyzing construct validity of the scale can be an important first step in guiding predictive studies on the teaching of agricultural curriculum and whether infusion of SA in the agriculture curriculum can contribute significantly to the broader goals of society (Muma, 2006). Such a contribution is needed to resolve the current problems such as environmental pollution and food safety in the agricultural industry (Muma et al., 2010). The study objectives were to analyze for the self-made ACAP scale:

1. Alpha Coefficient
2. Corrected item-total correlations; and
3. Rotated varimax factor principal components coefficients

### *1.1 Methodology*

#### *1.1.1 Population and Sample*

The population was made up of 2,904 high school agriculture teachers. The teachers were from the NCR states (Muma et al., 2010) (Table 1). The sampling frame error was controlled for by use of an updated list of teachers (Muma et al., 2010). Most teachers taught plant science, soil science and agronomy. They were natural science teachers and were assumed to be similar. A random sample of 844 teachers was drawn from the 12 states and stratified by the teacher population of a state.

#### *1.1.2 Data Collection*

The Tailored Design Method of Dillman (2000) was employed. Just one reminder was given to non-respondent teachers to return the completed questionnaires because of resource constraints. There were a total of 239 useable questionnaires returned. This represented a 28% response rate. Early and late respondents were compared on the research variables to control for non-response error. The difference between the two groups on the main research variable was not statistically significant (Muma et al., 2010) (Table 2). Because there was no statistically significant difference between the two groups, the findings were generalized to the target population (Linder, Murphy, & Briers, 2001; Muma et al., 2010).

#### *1.1.3 Scale Construction*

An Alternative-Conventional Agriculture Paradigm scale was self-developed for the SA beliefs scale. The scale is based on the six elements that distinguish respondent beliefs between SA and CA (Beus & Dunlap, 1991 cited in Muma et al., 2010). A total of 20 items were included in the self-administered questionnaire by drawing at least 3 items from each of the six elements of SA/CA paradigms. Research literature on beliefs/perceptions of farmers, the public, and teachers regarding SA practice and perceptions of selected SA practices were used to generate all elements of the SA construct. Thus the construct validity for the instrument was partly established (Beus & Dunlap, 1990, 1991, 1992, 1994 cited in Muma, 2006). The number of 20 items included in the scale was relatively large. According to Lawler (1967 cited in Muma et al., 2010), this ensured the construct was measured validly and completely. Two professors and a panel of 9 graduate students from the Agricultural Education and Studies Department at Iowa State University established instrument content and face validity. All were familiar with SA in the NCR.

The mentioned panel judged content of SA elements in the scale complete in relation to NCR. The panel thus determined content validity for the instrument (Muma et al., 2010) (Table 3). The adequate number of items included in the scale and thus a multiplicity of traits or factors representative of the entire universe SA construct ensured the instrument achieved content validity (Muma, 2006). A pilot-study on a random sample of 48 high school agriculture teachers in Iowa State was used to determine inter-item consistency for the instrument (Muma et al., 2011). The teachers were excluded from the main study. One item was deleted for having a relatively low inter-item correlation.

### 1.1.4 Analysis of Data

The following statistics were generated from data analysis: frequencies, percentages, means, standard deviations, mean item, mean inter-item, and corrected item total correlations, coefficient alpha, Eigenvalues and principal component coefficients (Muma et al., 2011). Two-tailed non-directional null hypotheses were tested using  $\alpha = 0.05$  level of significance. Data were analyzed using SPSS® and SAS®.

## 2. Results

The research population and sample data are summarized (Table 1). Table 2 summarizes how response error was controlled for. Since there was similarity between the two groups on the main research variable of teacher beliefs or paradigms of SA/CA, results are generalized to the target population (Muma et al., 2010).

Table 1. Population, samples and response rates of high school agriculture teachers by states in the NCR

State	Population and Sample		Sample Adjusted for Low Responses		Response Rates	
	Number of Teachers, <i>N</i>	Proportional Sample, <i>n</i> (%)	<i>n</i>	%	<i>n</i>	Return %
Illinois	315	80 (10.81)	80	9.48	21	26.25
Indiana	243	62 (8.38)	57	6.75	17	29.82
Iowa	178	45 (6.13)	62	7.35	18	29.03
Kansas	181	46 (6.23)	56	6.64	18	32.14
Michigan	67	17 (2.30)	40	4.74	8	20.00
Minnesota	239	61 (8.23)	62	7.35	11	17.74
Missouri	427	109 (14.70)	104	12.32	28	26.92
Nebraska	132	34 (4.59)	60	7.11	21	35.00
North Dakota	237	61 (8.16)	61	7.22	6	9.84
Ohio	492	125 (16.94)	118	13.98	48	40.68
South Dakota	80	20 (2.75)	60	7.11	18	30.00
Wisconsin	313	80 (10.78)	84	9.95	27	32.14
Total	2,904	740 (100)	844	100	240	28.44

Source: Own compilation

Note: *n* = number of teachers with completed questionnaires

The instrument was analyzed for reliability and inter-item consistency (Muma et al., 2011). The mean inter-item total correlation was .20 (Table 3). The proportion of items with mean inter-item correlation greater than .25 was 30% (results not shown) and was greater than for the 12-item scale which was at 17% (Jackson-Smith and Buttel, 2003). The proportion of items with mean inter-item correlation less than .1 was 20% (results not shown) and was slightly greater than for the 12-item scale (17%). Cronbach's Coefficient Alpha that measures reliability (mean of all possible split-half correlations or reliabilities) of the instrument was 0.82 (.83 standardized), representing a relatively high internal instrument consistency.

Table 2. Comparison of early and late respondents of high school agriculture teachers from the NCR states on research variables

Variable	Early Respondents			Late Respondents			<i>t</i> -test
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	
Extent sustainable agriculture taught	117	3.15	0.70	110	3.17	0.78	-0.18
Years teacher taught agriculture	122	16.07	10.05	117	16.56	9.83	-0.38
Extent methods used for teaching SA	119	3.06	0.69	114	3.03	0.76	0.38
Beliefs about sustainable agriculture	119	3.66	0.45	112	3.65	0.41	0.11
Perceptions about sustainable agriculture	117	3.90	0.59	109	3.88	0.53	0.28
Years teacher lived full-time on a farm	119	20.16	16.64	115	17.69	15.72	1.17
Years teacher worked full-time on a farm	120	12.20	14.73	114	10.50	12.92	0.94
Years teacher lived part-time on a farm	119	8.18	12.55	115	11.42	14.35	-1.84
Years teacher worked part-time on a farm	119	12.18	13.85	115	16.88	15.17	*2.47

Source: Adapted from Muma, 2006

Note: SA = sustainable agriculture; *n* = number of teachers completing questionnaire; *t*-test = *t*-test statistic; SD = Standard deviation; \* = *t*-statistic significant ( $p < .05$ ).

The self-made instrument exhibited relatively stronger instrument reliability comparable to the 12-item scale with its two subscales which were relatively lower at, respectively, .72, .68 and .54 (Jackson-Smith and Buttell, 2003) but not to the 24-item scale (.88) (Beus & Dunlap, 1991). Corrected item-total correlations was computed to further assess the internal consistency and coherence of the self-made ACAP scale. The value of the mean item-total correlation was .40. This was greater than the value for the 12-item scale (.35) but less than the value for the 24-item (.46) ACAP scale (Table 3).

Table 3. High school agriculture teacher scores on corrected item-total correlations, mean-item total correlations, mean inter-item correlations, and coefficient alpha for the self-made ACAP scale

Sustainable Agriculture Belief Statement	Mean	SD	Corrected item-total correlation
1. Promotion of healthy soils is important for SA	2.68	1.02	.57
2. SA conserves natural resources for future generations	3.45	1.02	.69
3. Crop rotation promotes achievement of SA	3.85	.89	.41
4. SA promotes regeneration of renewable natural resources	3.58	.89	.57
5. SA values nature for its sake	3.93	.80	.32
6. Agricultural knowledge from extension is important for the success of SA	3.51	1.00	.51
7. Knowledge exchange on locally designed technologies among farmers promotes SA	3.62	.98	.35
8. Integrating crops with livestock farming promotes SA	3.22	1.09	.57
9. Local agricultural practices promote success of SA	3.55	.85	.50
10. Innovations in agricultural technology promotes success of SA	3.10	1.04	.26
11. SA enhances local processing of agricultural produce	3.90	.75	.44
12. SA promotes local marketing of agricultural produce	3.45	.90	.50
13. SA promotes specialized crop and livestock farming	3.48	.85	.31
14. Local knowledge of farming in a community is an indication of sustainability in agriculture	3.93	.82	.55
15. Rural landscape quality and aesthetics are emphasized in SA practices	3.94	.91	.32
16. SA reduces reliance on external input sources	4.24	.90	.28
17. SA increases returns to farm labor	4.15	.87	.24
18. Farm-size is related to the intensity of farm management needed to attain SA	4.14	.98	.22
19. The size of a community influences SA development	3.87	.73	.31
20. SA aims at low farm capital investment and technology	3.55	.91	.08
Mean item-total correlations			.40
Mean inter-item total correlations			.20
Coefficient Alpha			.82

Source: Adapted from Muma, Martin and Shelley et al., 2010

Note: SD = Standard deviation

The relatively strong internal consistency of the self-made 20-item scale compares to the internal consistency for the 24-item ACAP scale used by Rasmussen & Kaltoft (2002) to gauge agricultural university faculty and student SA/CA paradigms at a university in Denmark. The mean item-total correlations for the various study groups in the above study were comparable to the mean value found in this study and ranged from .38 to .67. Some of the generic variables in the self-made scale in this study that match the same variables under the six elements of the ACAP scale (Beus & Dunlap, 1991; Rasmussen & Kaltoft, 2002) had relatively high item-total correlations of at least .20.

The following generic variables each of which can be grouped into approximately the same category in the six elements of the ACAP scale (Beus & Dunlap, 1991, 1992) had relatively high item-total correlations, respectively, in this and Rasmussen and Kaltoft's (2002) studies (numbers represent item number labels on Table 3 in this study; letters represent item labels in the original Beus and Dunlap's, 1991 study); item 3, L; item 4, S; item 16, C; and item 17, W. It is important to note that although items labeled G, P, T and V in the ACAP scale (Beus and Dunlap) were found to have among the lowest item-total correlation values in the Rasmussen and Kaltoft's (2002) study, the variables had relatively high item-total correlation values in the Beus and Dunlap's study (at least .32) and this study (at least .20). The variables which can be regarded as equivalents within the six elements of the ACAP scale which had relatively high item-total correlations (at least .20) in this and Beus and Dunlap's (1991) studies were (numbers represent item number labels on Table 3 in this study; letters represent

item labels in the original Beus and Dunlap’s, 1991 study); item 2, Q; item 3, L; items 4, 5, N,S; item 8, P; items 9, 14, G; items 11, 12, U; item 13, T; item 16, C; item 18, E, I, O; item 19, A, H.

Table 4. Results of factor analysis for high school agriculture teachers using self-made 20-item Alternative-Conventional Agriculture Scale items

*Sustainable Agriculture Belief Statement		Unrotated factor <sup>a</sup>	Varimax rotated factor loadings <sup>b</sup>					
			1	2	3	4	5	6
1	.80	<b>.76</b>	.33	.10	.14	.02	.14	
2	.69	<b>.76</b>	.15	.09	.15	.13	-.03	
3	.69	<b>.70</b>	-.07	.00	-.18	.18	.20	
4	.69	<b>.69</b>	.31	-.01	.22	.04	.04	
5	.63	<b>.68</b>	.08	.34	-.04	.04	.11	
6	.61	<b>.40</b>	.30	.37	.16	.12	.02	
7	.61	.00	<b>.63</b>	.16	-.22	.27	.19	
8	.56	.26	<b>.58</b>	.30	.03	-.04	.17	
9	.52	.15	<b>.58</b>	.04	-.33	.23	-.23	
10	.51	<b>.42</b>	<b>.49</b>	.29	.19	-.22	-.15	
11	.41	.20	<b>.46</b>	-.07	.24	.00	.22	
12	.07	.25	-.09	<b>.75</b>	-.21	.10	-.17	
13	.43	.02	.30	<b>.72</b>	.24	.01	.12	
14	.32	.09	.23	<b>.56</b>	.24	.25	.39	
15	.35	-.06	-.08	.03	<b>.76</b>	.17	-.07	
16	.41	.26	.02	.11	<b>.74</b>	-.05	-.05	
17	.33	.09	.06	.15	.08	<b>.80</b>	.12	
18	.23	.12	.10	.01	.04	<b>.75</b>	-.19	
19	.32	.14	.16	.01	-.08	-.03	<b>.78</b>	
20	.39	<b>.49</b>	-.04	.09	-.09	-.13	<b>.50</b>	
Initial Eigenvalue		5.22	1.69	1.65	1.33	1.09	1.06	
Rotation sums of squared loadings		3.45	2.1	1.92	1.71	1.60	1.40	
Percent of variance		26.11	8.50	8.26	6.62	5.46	5.31	

Source: Own compilation

Note: \* = Itemized beliefs statement about sustainable agriculture are labeled in Table 3; <sup>a</sup> = Unrotated factor components; <sup>b</sup> = Rotated principal components; **0.40, 0.50, 0.60** ... = high rotated varimax factor loadings

All the above indicated that on average, all items in the 20-item scale represented the same underlying universal construct as compared to the Beus and Dunlap’s (1991) scale than to the Jackson-Smith and Buttell’s (2003) scale. This is so given that the mean figure for the 24-item scale was for the full range of known groups combining alternative and conventional agriculture adherents and statewide farmers in Washington State in the Beus and Dunlap’s (1991) study. Teachers being not members of the two extreme camps in the SA/CA adherents can be expected to score a relatively lower value of corrected item-total correlation on an ACAP scale and coefficient alpha than would a population comprising the full range of groups in the SA/CA debates (Beus & Dunlap, 1991, 1994). It is equally important to note in particular that the scoring patterns for some individual items in the ACAP scale were not necessarily the same in the self-made 20-item and 12-item scales.

In an approach similar to Beus and Dunlap’s (1991) analysis of the ACAP scale for predicting adherence to SA/CA, a principal components analysis was performed to test for the construct validity of the 20-item self-made ACAP scale (Table 4). Unrotated and rotated factor loadings for individual items are reported. Ten out of 20 items in this study had unrotated factors less than .5 while the other half had unrotated factors greater than .5. At least 7 items (35%) out of the 20 items had unrotated items with coefficients greater than .6. Beus and Dunlap’s ACAP scale had 6 (30%) out of 24 items with unrotated loadings greater than .5 and only 4 (20%) items with unrotated loadings greater than .6. Jackson-Smith and Buttell’s (2003) 12-item scale had 5 items (42%) with unrotated loadings less than .5 and only 2 (17%) items with unrotated loadings greater than .6. The self-made ACAP scale fared better in the first unrotated factor loadings on most items than had both Beus and Dunlap’s (1991) and Jackson-Smith and Buttell’s (2003) ACAP scales which had relatively similar results regarding unrotated first factor loadings on most of the items on each scale. The two latter scales had also similar results

regarding variance explained in the answer sets of each scale which was, respectively, one quarter of variance.

A varimax factor analysis was also performed on the self-made scale to help assess the scale for potential multi-dimensionality. Six factors were extracted (Table 4). Eight of the 20-item self-made scale items loaded on the first rotated factor; five and three variables, respectively, loaded on the second and third rotated factors while the fourth, fifth and the last rotated factors had two variables loading on each factor. Only the rotated first factor had a larger Eigenvalue than .5. The rest of the factors had Eigenvalues between 1.06 and 1.69. The first factor had explained over 26 percent of variance in the items in the self-made scale while the rest of the factors each explained a variance of under 10 percent in the items. Beus and Dunlap (1991) had extracted five rotated factors from the 24 item ACAP scale. Items 6, 10, 11, 14 and 20 had factor loadings of about the same strength in at least two or more factors suggesting unidimensionality of the scale according to Beus and Dunlap (1991) and Dunlap and Van Liere (2000). These findings are comparable to Beus and Dunlap's (1991) and Dunlap and Van Liere's (2000) findings on the ACAP scale.

### 3. Discussion

In general, the findings indicate that the self-made instrument based on the six elements of the SA/CA paradigms has a relatively high; alpha coefficient (.82), mean item-total correlation (.40), and a main unrotated factor or principal component explaining over 26 percent of variance of the scale items. These results are similar to the findings of Beus and Dunlap (1991) and Rasmussen and Kaltoft (2002) on the ACAP scale. The findings contradict the study of Jackson-Smith and Buttel on their 12-item ACAP scale.

The relatively high coefficient alpha, mean item total correlation, and unrotated and rotated first factors with modest numbers of items loading on them means that there is mainly one underlying construct in the instrument. It also means that the teacher population in the NCR holds views and attitudes about SA which are consistent. The teacher attitudes constitute an agricultural paradigm supporting SA practice. Further, the instrument items are coherent as components of a whole and are related. However, the teacher population seems not to hold stronger paradigmatic views as the ACAP scale can be expected to predict because of the relatively low mean item-total correlation and coefficient alpha realized for the instrument compared to what was found for the ACAP scale in both the Beus and Dunlap (1991) and Rasmussen and Kaltoft (2003) studies. This should be expected because agriculture teachers are not strong adherents of the two agricultural paradigms who can be expected to make extreme and polar scores on the ACAP scale. Strong adherents of SA/CA paradigms such as proponents of the two paradigms are in contact with each other and set social goals and means to realize them and clarify new advocated values and practices from the old ones (Beus & Dunlap, 1991). Therefore, the findings of Jackson-Smith and Buttel (2003) on the ACAP scale are not supported in this study.

### 4. Conclusion

The relatively high; alpha coefficient (.82), mean item-total correlation (.40), and a main unrotated factor or principal component explaining over 26 percent of variance of the scale items implies the instrument has construct validity. The instrument can therefore be used to preliminarily gauge the paradigmatic orientation of agriculture teachers in the NCR or other regions of the US since the items used for construction of the scale are generic. Because there was no known groups supporting the two polar paradigms of agriculture to help further confirm the construct validity of the instrument, more research with the instrument with such groups and farmers is necessary to establish the validity of the scale. The instrument can also be improved by deletion or reconstruction of the variables with the lowest item-total correlations to increase item consistency and coherence and its validity.

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