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# Development of Test and Measurement of Knowledge Level of Sunflower Farmers

Bhumireddy Chandhana[1], G. D. S. Kumar[2]* and R. S. Sengar[3]

[1]Ph.D. Scholar, [3]Professor, Department of Agricultural Extension, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492012, Chhattisgarh, India
[2]Principal Scientist, Indian Council of Agricultural Research-Indian Institute of Oilseeds Research, Rajendranagar–500030, Hyderabad, India
*Corresponding author email id: gd.satishkumar@icar.gov.in

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ABSTRACT

A test was constructed to measure the farmers' knowledge level on sunflower cultivation during 2021-22. Relevant items were collected from review of literature and discussed with scientists. For relevancy test, 39 items were sent to 320 experts for their judgement. Based on 45 experts judgement, 18 items (overall mean score > 2.57) were selected for item analysis and administrated to 60 farmers of Chinnakoduru village of Siddipet district. Item analysis was done by item difficulty index, item discrimination index and point biserial correlation and 15 items were finalized for knowledge test. Reliability (Cronbach alpha, Spearman brown coefficient and Guttman split-half) and validity (point biserial correlation) were estimated for standardization of the test and found to be highly significant. The test was administered to 140 respondents in Andhra Pradesh and Telangana states. In Andhra Pradesh, 78.8 per cent and in Telangana 85.0 per cent of respondents were in medium level of knowledge category. The item analysis indicated significant differences in knowledge level of farmers pertaining to most suitable period of sowing sunflower crop during *Rabi*, suitable sunflower hybrids, optimum seed rate, critical period of weed competition, application of fertilizers and bee keeping in sunflower in two states.

## INTRODUCTION

In India, oilseeds were cultivated over an area of 28.7 m ha with a production of 38.4 m t and productivity of 1339 kg/ha (Directorate of Economics and Statistics, 2021-22). India produces around 10.4 m t of edible oil from primary (7.0 m t) and secondary sources (3.4 m t) and imports around 12.9 m t of edible oil to meet the domestic demand of edible oil (The Solvent Extractors' Association of India, 2021-22). The huge demand of edible oil is mainly because of increasing population pressure, raised standard of living and high consumption. It is necessary to increase oil seeds production for reducing imports and moving towards self-sufficiency. Sunflower can play an important role to meet over the shortage of oil in the country because of its short duration, photo-insensitive, wide adaptability to different agro-climatic regions and rainfed crop. Sunflower (*Helianthus annus* L.) belongs to the family Asteraceae and the genus *Helianthus*. The oil content in the seeds varies between 35 to 43 per cent. The unsaturated fatty acids such as oleic and linoleic comprise about 90 per cent of the total oil content. Sunflower oil is quite popular as healthy cooking oil because of its nutritional benefits. In India, it is cultivated over an area of 2.90 lakh ha with a production of 2.36 lakh t and productivity of 0.9 t/ha (Directorate of Economics and Statistics, 2020-21). Major sunflower growing states are Karnataka, Odisha, Andhra Pradesh, Maharashtra, Telangana, Bihar, Tamil Nadu, West Bengal, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat. Sunflower production has drastically declined since 2007-08 from 14.63 lakh t to 2.36 lakh t in 2020-21 (Directorate of Economics and Statistics, 2020-21). The production of sunflower crop is low in India and the major reasons were rainfed cultivation, small operational landholdings, lack of varietal replacement, losses due to pests and diseases, and low knowledge level and low adoption of improved varieties, technologies and other management

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practices by farmers. Knowledge plays an important role in increasing the production of sunflower. In order to increase the cognitive domain of sunflower farmers, it is crucial to identify their existing knowledge on the recommended package of practices. For assessing the knowledge level of farmers, there is a need for developing a suitable measurement tool, such as a cognitive scale (Rajkamal, 2001). Standardising the knowledge test is not very usual for assessing knowledge through knowledge tests (Khan et al., 2006). Hence, in the present study a knowledge test was developed, standardised and administered to assess the level of knowledge of Andhra Pradesh and Telangana farmers on different aspects of sunflower production practices. It also included information on knowledge gaps and the transfer of technologies for knowledge items between the two states.

## METHODOLOGY

Knowledge test was constructed by using the procedure followed by Lindquist (1951). knowledge test was developed using scientific procedures, including item collection through preliminary screening, item selection based on expert opinions, item analysis (difficulty index, discrimination index), testing reliability and validity of knowledge test and final administration to respondents. Items related to knowledge of sunflower were collected from review of literature, personal experience, books, scientists, research articles, professors and panel discussion. Thirty nine items were collected and sent to 320 experts for relevancy test on three point continuum through google forms, email and personal contact and forty five judges responded within the stipulated time. Out of 39 items, 18 items were selected for item analysis based on the mean score > 2.57. Selected items were administrated to 60 farmers of Chinnakoduru village of Siddipet district for item analysis. Item difficulty index ($P_i$) and item discrimination index were used for item analysis. $P_i$ was estimated with the same formula used by Kumar et al., (2015) & Sinha et al., (2020) also followed the same procedure.

$P_i$ = Number of respondents giving correct answer / Total number of respondents to whom $i^{th}$ item is administrated (N=60).

Item discrimination index used to discriminates respondents who had rich and poor knowledge on particular item. Total scores of 60 farmers were arranged in descending order and then respondents were split into six equal groups *viz*., G1, G2, G3, G4, G5 and G6 with 10 respondents in each group. The two medium groups G3 and G4 were excluded for item analysis, keeping only four extreme groups G1 and G2 with high scores and G5 and G6 with low scores. Item discrimination index ($E^{1/3}$) was calculated with the following formula used by Sureshverma et al., (2018); Rani et al., (2020) and as follows:

$$E^{1/3} = \frac{(G1 + G2) - (G5 + G6)}{N/3}$$

Where, ($E^{1/3}$) = Discrimination index for $i^{th}$ item, G1, G2, G5 and G6 indicated the frequencies of correct answers given for the respective sub-groups of respondents for an item in the test, N = Total number of respondents of the sample selected for the item analysis.

After estimating the item difficulty and discrimination index values, 18 items were tested for the validity by point biserial correlation ($r_{pbis}$) based on the procedure followed by Varma (2007). Cronbach alpha, Guttman split-half and Spearman brown coefficient were used for testing the reliability of the scale. Point biserial correlation (Item-total correlation) and experts' opinion were used for testing the validity of the test. Based on RSI and RYI values, Kadapa and Nizamabad districts from Andhra Pradesh and Telangana states were selected respectively. From each district two mandals and four villages were selected based on highest area under sunflower. Thus a total of four mandals and eight villages were selected. From each village, 20 and 15 respondents were selected by random sampling method from Kadapa and Nizamabad districts, respectively. Thus, 80 and 60 respondents were selected from Kadapa and Nizamabad districts. The data were collected with the help of semi-structured schedule by personal interview method. The data were subjected to analysis using SPSS v.20.

## RESULTS AND DISCUSSION

The results of the item difficulty index showed that Pi values ranged from 0.50 to 0.65 (Table 1). Items with values < 0.20 and > 0.80 were considered as very easy and very difficult items, respectively. The values of all items were within the range and total items (18) were included in the test for further analysis. An item's discrimination, value describes how well an item determines the value of the item battery. A higher $E^{1/3}$ value indicates that the item has validity. Acceptable range is between 0.30 to 0.70. The results of $E^{1/3}$ values ranged between 0.05 to 0.75 (Table 1). Items with $E^{1/3}$ value lower than 0.11 (0.05 ($2^{nd}$), 0.05 ($9^{th}$) and 0.10 ($14^{th}$) were excluded from the test. Hence out of 18 items, 15 were retained in the final knowledge test. Point biserial correlation coefficient is used to determine the internal consistency of dichotomous or binary items. It indicates the relationship between the overall score and a dichotomized response for each particular item. Thus $r_{pbis}$ revealed information on how well an item measures or distinguishes in respect to the rest of the test. Acceptable range was between > 0.25-0.70. From table 1 items having $r_{pbis}$ value -0.10 ($2^{nd}$), -0.10 ($9^{th}$) and 0.08 ($14^{th}$) were excluded from the test. Therefore 15 items were selected for the final test out of 18 items.

Three criteria for item selection were items having difficulty index, discrimination index and point biserial correlation coefficient values ranging between > 0.25 to 0.70.

### Reliability

Reliability was tested by calculating Cronbach alpha ($\alpha$), Spearman-brown coefficient and Guttmann split-half coefficient. $\alpha$ value for knowledge test was found to be >0.75 for each item with overall $\alpha$ value of 0.78 (Table 3). The results were in conformity with Priyadarshni et al., (2021). Spearman-brown coefficient and Guttman split-half coefficient value was found to be 0.63 for each (Table 2). Paul et al., (2020); Kumar et al., (2016) also used spearman brown coefficient.

### Validity

Content validity and point biserial correlation were used for testing the validity of knowledge test. For ensuring content validity

**Table 1.** Difficulty and discrimination indexes for knowledge items and point biserial correlation in sunflower

| Items | Frequency of correct answers given for 4 extreme groups (N=10) | | | | Total frequency of correct answers | Item difficulty Index | Item discrimination index | Point biserial correlation | Item selected for the study |
|---|---|---|---|---|---|---|---|---|---|
| | G1 | G2 | G5 | G6 | (N=60) | ($P_i$) | ($E^{1/3}$) | ($r_{pbis}$) | |
| 1. | 8 | 7 | 3 | 3 | 31 | 0.52 | 0.45 | 0.31 | Accepted |
| 2. | 7 | 5 | 5 | 6 | 38 | 0.63 | 0.05 | -0.10 | Rejected |
| 3. | 9 | 7 | 4 | 2 | 34 | 0.57 | 0.50 | 0.39 | Accepted |
| 4. | 10 | 8 | 4 | 2 | 34 | 0.57 | 0.60 | 0.38 | Accepted |
| 5. | 10 | 8 | 2 | 1 | 34 | 0.57 | 0.75 | 0.55 | Accepted |
| 6. | 10 | 7 | 2 | 3 | 34 | 0.57 | 0.60 | 0.38 | Accepted |
| 7. | 10 | 7 | 3 | 3 | 38 | 0.63 | 0.55 | 0.39 | Accepted |
| 8. | 10 | 6 | 6 | 2 | 36 | 0.60 | 0.40 | 0.30 | Accepted |
| 9. | 7 | 7 | 7 | 6 | 36 | 0.60 | 0.05 | -0.10 | Rejected |
| 10. | 9 | 8 | 4 | 3 | 33 | 0.55 | 0.50 | 0.29 | Accepted |
| 11. | 9 | 9 | 6 | 4 | 39 | 0.65 | 0.40 | 0.29 | Accepted |
| 12. | 9 | 9 | 3 | 2 | 34 | 0.57 | 0.65 | 0.46 | Accepted |
| 13. | 7 | 8 | 3 | 2 | 33 | 0.55 | 0.50 | 0.28 | Accepted |
| 14. | 8 | 6 | 8 | 4 | 39 | 0.65 | 0.10 | 0.08 | Rejected |
| 15. | 10 | 9 | 3 | 4 | 35 | 0.58 | 0.60 | 0.40 | Accepted |
| 16. | 9 | 8 | 4 | 2 | 37 | 0.62 | 0.55 | 0.36 | Accepted |
| 17. | 9 | 8 | 5 | 2 | 31 | 0.52 | 0.50 | 0.32 | Accepted |
| 18. | 8 | 7 | 2 | 1 | 30 | 0.50 | 0.60 | 0.43 | Accepted |

**Table 2.** Reliability statistics of sunflower knowledge test

| Reliability Statistics | | | |
|---|---|---|---|
| Cronbach's Alpha (α) | Odd number items | α value | 0.66 |
| | | N of Items | 8[a] |
| | Even number items | α value | 0.73 |
| | | N of Items | 7[b] |
| | Total N of Items | | 15 |
| Correlation Between Forms | | | 0.46 |
| Spearman-Brown Coefficient | Equal Length | | 0.63 |
| | Unequal Length | | 0.63 |
| Guttman Split-Half Coefficient | | | 0.63 |

a. Odd number items, b. Even number items

each item was provided to a relevant expert who would assess the item's relevance and appropriateness as well as how well the test represented the universe. The construct validity of the test was then determined by calculating the point bi-serial ($r_{pbis}$) correlation of each item. Reddy et al., (2017) also followed point biserial correlation for testing the validity. For the final selected items, point biserial correlation values (corrected item-total correlation) were represented in table 3. Varma, (2007) suggested that items have to be atleast $r_{pbis}$ value of 0.15 and good items have $r_{pbis}$ values more than 0.25. Therefore for final knowledge test items in this study were selected based on their significant $r_{pbis} > 0.25$.

From Table 3, it was observed that more than three-fourth (83%) of Telangana farmers had knowledge on the optimum time of sowing sunflower during *rabi* season, whereas in Andhra Pradesh, 56 per cent of farmers had knowledge on optimum time of sowing. Andhra Pradesh farmers had knowledge gap compared to Telangana farmers and there is need for technology transfer on sowing time by conducting farmers meeting and field days. Majority of the farmers of Telangana (83%) and Andhra Pradesh (56%) had knowledge on critical period for weed competition. In case of pests (white fly, *Spodoptera* and head borer) and diseases (necrosis, alterneria leaf blight and powdery mildew), most of the farmers of Telangana (87% and 80%) and Andhra Pradesh (59% and 58%), respectively had required knowledge. There were highly significant differences ($p<0.01$) between the farmers of two states. Hence, there is need for technology transfer on integrated disease management and integrated pest management through intensive campaigns, demonstrations and farmers trainings. Majority of the Telangana (82%) and Andhra Pradesh (66%) farmers had knowledge in case of suitable hybrids (Pro sunny/ Pioneer/ Sumithra/ Sunbreed) for cultivation of sunflower crop. More than three-fourth (80%) of farmers from Telangana and 64 per cent from Andhra Pradesh had knowledge on optimum seed rate in sunflower (2 kg/acre). Farmers of Andhra Pradesh had low knowledge on suitable cultivar and seed rate compared to Telangana farmers and there is need for technology transfer on high yielding varieties through use of ICT's and timely access to quality seeds and other inputs. In case of recommended dose of fertilizers under rainfed and irrigated conditions, farmers from Telangana (82% and 83%) and Andhra Pradesh (65% and 66%) had sufficient knowledge, respectively. Less number of farmers from Andhra Pradesh had knowledge compared to Telangana and hence, there is need for technology transfer on integrated nutrient management. Most of the farmers from Telangana (90%) and Andhra Pradesh (76%) had knowledge

**Table 3.** Final knowledge test and knowledge level of Andhra Pradesh and Telangana farmers

| S.No. | Items | Corrected item-total correlation | α if item deleted | Andhra Pradesh F (%) | Telangana F (%) | Z-value |
|---|---|---|---|---|---|---|
| 1. | What type of soil is suitable for sunflower cultivation? a. Light soil, b. Heavy soil, c. Mixed soil, d. Light textured soil | 0.32 | 0.77 | 53(66) | 48 (80) | 1.85$^{NS}$ |
| 2. | What is the best season to grow sunflower crop? *a. Kharif, b. Rabi, c.* Summer, *d.* All the above | 0.43 | 0.76 | 48 (60) | 45 (75) | 1.90$^{NS}$ |
| 3. | What is the most suitable period for sowing sunflower crop in *Rabi*? | 0.33 | 0.77 | 45 (56) | 50 (83) | 3.66$^{**}$ |
| 4. | Can you name any hybrid of sunflower _____ | 0.57 | 0.75 | 53 (66) | 49 (82) | 2.10$^{*}$ |
| 5. | Do you know about seed treatment? Yes/No If, yes give the details | 0.39 | 0.77 | 43 (54) | 40 (67) | 1.55$^{NS}$ |
| | S.No. \| Name of biocontrol agent \| Quantity (g/kg)<br>1. \| \| \|<br>2. \| \| | | | | | |
| 6. | Do you know about chemicals for seed treatment? Yes/No. If, yes give the details | 0.43 | 0.76 | 45 (56) | 42 (70) | 1.68$^{NS}$ |
| | S.No. \| Name of chemicals \| Quantity (g/kg)<br>1. \| \| \|<br>2. \| \| | | | | | |
| 7. | Do you know the seed rate of sunflower per acre? a. 2 kgs, b. 3 kgs, c. 4 kgs, d. 5 kgs | 0.34 | 0.77 | 51 (64) | 48 (80) | 2.16$^{*}$ |
| 8. | What is the critical period of weed competition in sunflower? ____ weeks | 0.29 | 0.77 | 45 (56) | 50 (83) | 3.66$^{**}$ |
| 9. | What is the recommended dose of NPK for sunflower under rainfed conditions N: __ kgs/acre**,** P : __ kgs/acre, K: __ kgs/acre | 0.31 | 0.77 | 52 (65) | 49 (82) | 2.26$^{*}$ |
| 10. | What is the recommended dose of NPK for sunflower under irrigated conditions N: __ kgs/acre**,** P : __ kgs/acre, K: __ kgs/acre | 0.49 | 0.76 | 53 (66) | 50 (83) | 2.37$^{*}$ |
| 11. | Do you know application of Boron improves seed yield and seed weight? Yes/ No. If yes, mention the dosage? | 0.32 | 0.77 | 51 (64) | 47 (78) | 1.95$^{NS}$ |
| 12. | List out any three important pests which cause major damage to sunflower and mention their control measures<br>Pests Control Measures<br>i._____ i._____<br>ii._____ ii._____<br>iii._____ iii._____ | 0.44 | 0.76 | 47 (59) | 52 (87) | 3.94$^{**}$ |
| 13. | List any three important diseases which cause major damage to sunflower and mention their control measures<br>Pests Control Measures<br>i._____ i._____<br>ii._____ ii._____<br>iii._____ iii._____ | 0.37 | 0.77 | 46 (58) | 48 (80) | 2.95$^{**}$ |
| 14. | Do you know that honeybee activity in sunflower crop increases yield? Yes/No | 0.30 | 0.77 | 61 (76) | 54 (90) | 2.22$^{*}$ |
| 15. | Mention the correct stage of harvesting sunflower crop? a. Lemon yellow colour on the back of head,b. Complete drying of heads, c. Complete drying of plants, d. Shedding of leaves | 0.43 | 0.76 | 64 (80) | 53 (88) | 1.35$^{NS}$ |
| | Overall Cronbach alpha | | 0.78 | | | |

** = Significant at 0.01 level of probability, * = Significant at 0.05 level of probability and NS = Non-significant

on positive effects of bee keeping in increasing yield of sunflower crop. Andhra There is need for technology transfer on bee keeping in sunflower through awareness campaigns, result demonstrations and field days. There were significant differences in knowledge level of farmers between the two states ($p<0.05$) and hence, concerted efforts are required to educate the farmers on suitable hybrids for the region, optimum seed rate, INM and positive effects of bee keeping in sunflower crop. Most of the farmers of Telangana (80%) and Andhra Pradesh (66.3%) had knowledge on suitable soils for cultivating sunflower crop. Majority of the farmers of Telangana (75%) and Andhra Pradesh (60%) had knowledge on the best season for growing sunflower crop. In case of seed treatment with biocontrol agents (Trichoderma @ 5 g/kg seed, Pseudomonas @ 8 g/kg seed, Azospirillum @ 240 g/acre, Phosposolublizing bacteria @ 240 g/acre, and chemicals (Thiram/ Captan/ Metalxyl-6/ Imidacloprid-5), most of the farmer from Telangana (67% and 70%) and Andhra Pradesh (54% and 56%), respectively had sufficient knowledge. More than three-fourth (78%) of Telangana and Andhra Pradesh (64%) farmers had sufficient knowledge that boron (2 g/l) application increases seed yield and seed weight. Majority of the farmers from Telangana (88%) and Andhra Pradesh (80%) had knowledge on correct stage of harvesting of sunflower crop (lemon yellow colour on the back of the head). There were no significant differences in knowledge level of farmers between the two states in these practices. These results were similar with that of Rajan et al., (2021); Rai et al., (2016); Devarani & Bandhyopadhy (2016) & Mandavkar et al., (2013).

## CONCLUSION

Sunflower knowledge test was developed and standardised by using reliability and validity. The knowledge level of farmers of Telangana and Andhra Pradesh differed significantly and it was observed that more number of farmers of Telangana had knowledge on sunflower cultivation compared to Andhra Pradesh. In order to increase the knowledge on most suitable period for sowing of sunflower crop during *Rabi* season, critical period of weed competition, pests and diseases, integrated weed management; integrated pest management, suitable cultivar and seed rate, recommended dose of fertilizers under rainfed and irrigated conditions and the benefits of bee keeping in sunflower, intensive transfer of technology had to be taken up by conducting campaigns, farmers meeting, demonstrations and field days.

## REFERENCES


Devarani, L., & Bandhyopadhy, A. K. (2016). Development of gender-disaggregated knowledge test for measuring knowledge level of farmers in improved rice cultivation. *Indian Research Journal of Extension Education, 14*(1), 30-35.

Directorate of Economics and Statistics. (2022). Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India. https://eands.dacnet.nic.in/, assessed 2022.

Khan, P. M., Bhimawat, B. S., & Jitendra Chauhan. (2006). Standardizing knowledge test. *Indian Research Journal of Extension Education, 6*(3), 4-7.

Kumar, G. A., Sailaja, V., Satyagopal, P. V., & Prasad, S. V. (2015). Construction and standardization of knowledge test to measure the knowledge level of farmers on SRI technology. *Indian Research Journal of Extension Education, 15*(4), 161-166.

Kumar, R., Slathia, P. S., Peshin, R., Gupta, S. K., & Nain, M. S. (2016). A test to measure the knowledge of farmers about rapeseed mustard cultivation. *Indian Journal of Extension Education, 52*(3&4), 157-159.

Lindiquist, E. F. (1951). Educational Measurement. *American Council of Education*, Washington.

Mandavkar, P. M., Talathi, M. S., Mahadik, R. P., & Sawant, P. A. (2013). Farmer's knowledge and correlates of oilseed production technology. *Indian Journal of Extension Education and Rural Development, 21*, 15-19.

Paul, N., Kumar, R., & Slathia, P. S. (2020). Development and standardization of a test to measure knowledge of rajmash (*Phaseolus vulgaris* L.) growers. *Indian Journal of Extension Education, 28*, 62-68.

Priyadarshni, P., Padaria, R. N., Burman, R. R., Singh, R., & Bandyopadhyay, S. (2021). Development and validation of knowledge test on indigenous alder based jhum cultivation and mechanism for knowledge dissemination. *Indian Journal of Extension Education, 57*(1), 1-7.

Rai, D. P., Singh, S. K., & Pandey, S. K. (2016). Extent of knowledge and adoption of mustard production technology by the farmers. *Indian Research Journal of Extension Education, 12*(3), 108-111.

Rajkamal, P. J. (2001). Cognitive scale to measure knowledge in backyard poultry keeping. *Journal of Extension Education, 12*(2), 65-68.

Rajan, P., Nahatkar, S. B., & Thomas, M. (2021). Farmers' Knowledge on Soybean Production Technologies in Madhya Pradesh. *Indian Journal of Extension Education, 57*(4), 139-142.

Rani, N. S., Lakshmi, T., Gopal, P. S., Vani, N., & Reddy, B. R. (2020). Standard test to measure knowledge of groundnut farmers on sustainable cultivation practices. *International Journal of Current Microbiological Applied Science, 9*(1), 169-175.

Reddy, P. B., Sasidhar, P., & Sastry, T. (2017). Construction of knowledge test to measure the knowledge level of rice farmers. *Andhra Pradesh Journal of Agricultural Sciences, 3*(4), 236-241.

Sinha, S., Sankhala, G., & Lal, S. P. (2020). Construction of knowledge test to measure the knowledge level of dairy farmers vis-a-vis environment friendly dairy farming practices. *Indian Journal of Extension Education, 56*(1), 6-11.

Sureshverma, R., Samuel, G., Rao, I. S., & Sagar, V. (2018). Construction of knowledge test to measure the knowledge on recommended groundnut production practices. *Journal of Extension Education, 30*(3), 6129-6136.

The Solvent Extractors' Association of India (2022). NGO recognised Ministry of Agriculture, Government of India. https://seaofindia.com/ assessed on June, 2022.

Varma, S. (2006). Preliminary item statistics using point-biserial correlation and p-values. *Educational Data Systems Inc.: Morgan Hill CA. Retrieved, 16*(07), 1-7.