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**Communication for safety's sake: visual communication materials for pesticide users in Latin America**

# Communication for safety's sake: visual communication materials for pesticide users in Latin America

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JAMES I. GRIESHOP with DAVID WINTER†

*Department of Applied Behavioral Sciences, Cooperative Extension, University of California, Davis, CA 95616, USA*
*†World Wildlife Fund, Washington, D.C. 20037, USA*

**Abstract.** The dramatic increase in the use of pesticides has led to increasing political, social, human health, and environmental concerns. Accidents due to misuse among users have risen dramatically and speak to the need for the development of practical and useful communication programs and materials, particularly with small farmers. Three studies were designed to research and test the comprehensibility of sets of pictographs, pictures, and symbols depicting proper and improper procedures for using agricultural pesticides. Field testing was conducted with Mexican farm workers in California and small farmers and farm workers in Ecuador, South America. Results indicate that, like language, the meaning of symbols and visual literacy will have to be taught if the goal of perfect comprehensibility is to be achieved. Furthermore, research on visual communication materials and information systems in this area must become an integral part of formal and nonformal educational efforts. These efforts must be undertaken not only by communication researchers but also in conjunction with technical personnel.

In the last four decades science and technology have revolutionized worldwide agricultural practices. This Green Revolution has been fuelled partly by the introduction of chemical pesticides with unintended effects on human health and the environment. Although the accuracy of claims that over 500, 000 cases of pesticide poisonings occur annually in the Third World (Copplestone, 1977; Wasilewski, 1987) are challenged (GIFAP, 1986), the incidence of human poisoning and deaths associated with pesticide use is high. Such poisonings are primarily due to uninformed use, accidential misuse, and abuse of chemical pesticides.

Although the individual user of pesticides must make the decisions (and assume the consequences) regarding the use of pesticides, he or she must be informed of the hazards involved in their use. There are real risks associated with the use of pesticides. In many Third World settings special attention is called for regarding the manner of presenting risk and hazard information. The aim of efforts to present information must be to assist users to avoid risks and accidents, to avoid or prevent the misuse of materials (as well as ensuring their proper and safe use), and to prevent human health and environmental problems. Education, using a variety of approaches, must be brought to bear to prevent accidents, particularly in situations where pesticide users are illiterate and uninformed about the proper use of pesticides. The challenges to both educators and technical professionals for achieving these goals are great (VanHeemstra and Tordoir, 1982).

Some efforts at education have been initiated. Special booklets and posters focused on correct usage of pesticides (GIFAP; World Bank) and special training programs have been developed (Granovsky *et al.*, 1985; World Health Organization, 1978). Of particular interest to the three studies described below is the suggestion that pictures (or pictographs, logos, symbols) on labels and teaching materials should be used to educate and inform uneducated and illiterate users (Gore and Sleight, 1982; IPPC, 1983). In short, a picture can substitute for a thousand words. But, a picture not understood or misinterpreted has little positive, and sometimes may have negative, educational worth. The question common to the described studies is: can pictures, used as part of an information presenting system for users of pesticides, be deciphered by them? Can users typical of those found in the Spanish speaking developing world easily and quickly read and interpret safety messages in the form of pictographs, pictures, and symbols?

The urgency for developing effective educational materials and programs makes the determination of whether these users can quickly and accurately decipher and interpret the pictorial materials significant. The world is littered with the efforts of unsuccessful visual materials resulting from the lack of pretesting (Bertrand, 1978). When anyone uses potentially hazardous materials such as pesticides, messages on safe use must be unequivocal and easily understood. The risks involved in using pesticides are serious and can be life endangering. Misinterpretation or misunderstanding of messages may lead to catastrophic results. Although the only true goal for such visual messages might be 100% comprehension, such a goal is unrealistic. Nevertheless, a realistic objective must be to design visual materials and messages understandable by a high percentage of the targetted audiences.

Three related studies used visual materials, specifically black and white line drawings in the form of pictures and symbols, with intended messages related to the safe use of chemical pesticides. The studies sought to determine how well the pictures communicated the intended message‡. Of

‡The messages studied were predetermined but reflected those found on most well designed labels and in literature provided by manufacturers. They were: (1) Apply pesticides safely; (2) Correctly dispose of pesticide containers; (3) Wash clothing after using pesticides; (4) Wash and clean pesticide application equipment after use; (5) Mix pesticides safely; (6) Store pesticides in a secure place; (7) Do not reuse pesticide containers; (8) Read instructions before using; (9) Wear protective clothing and equipment when using pesticides. In addition, a variety of symbols to communicate positive or 'Do' messages and negative or 'Don't' messages were included.

primary interest was the *explicative* role of the pictographs (to assist in comprehending the messages) as opposed to the *attentional* role (to get the viewer's attention) or the *retentional* role (to aid in the recall of the message) (Duchastel, 1978). Since educational efforts that utilize such pictorial materials ideally are targetted to specific users, original materials were tested in the field with Spanish speaking adults who used commercially purchased pesticides. Subjects in these studies were involved in agriculture, and, for the most part, were representative of small farmers and farm workers from Mexico and Ecuador in South America. All interviews were conducted in Spanish. The three studies are summarized in Table 1.

*Table 1. Studies of comprehensibility of selected pictographs, symbols and pictures.*

| Study | Date | Subjects | Tasks |
|---|---|---|---|
| 1. Pictographs: Mexico/ Ecuador | Spring, 1984<br>Fall, 1984 | 33 Mexican farm workers<br>37 Ecuadorean farmers and farm workers | Decipher, interpret and respond to set of 19 pictographs |
| 2. Symbols | Fall, 1984 | 37 Ecuadorean farmers and farm workers | Decipher and respond to set of 6 positive and negative symbols |
| 3. Pictures with positive and negative symbols | Winter, 1984 | 98 Ecuadorean rural residents | Read and sort pictures into 'Correct', 'Incorrect' and 'Undecided' piles |

## Study 1: Pictographs: Mexico/Ecuador

The first study addressed the question of comprehension of pictographs intended to convey specific messages about the use of pesticides. A pictograph was defined as a graphic configuration that conveyed a 'naturally occurring visual form or relationship' (Barnard and Marcel, 1984).

Two sets of 19 identical pictographs were used (Table 2) and the sequential order of the pictographs in each set was randomly assigned. Each pictograph measured approximately 3·5 cm$^2$, printed in black ink on white cardboard, laminated and cut to a size of 10 cm$^2$. Pictographs 1–17 consisted of pictures alone, whereas items 18 and 19 included the word 'No' and a symbol (a black slash) intended to signify 'Do Not'.

### Method

Subjects, through random assignment, were presented with one of the two identical sets of pictographs, numbers 1 through 19 or numbers 19 through 1. Each was told that the researcher was interested in how pesticides are used and how best to communicate with users about the safe use of pesticides. It was indicated that there were no correct or incorrect ways to answer and that the viewer's answers were important and correct. The viewer was asked to read and respond to each pictograph. Responses were recorded in writing by the interviewers as accurately as possible. The sole prompt for further responses was, 'Anything else?'. Although each respondent was offered the opportunity to review and change their responses, none did.

The 33 Mexican respondents were farm workers attending two special vocational training programs in rural California. Interviews of the 37 Ecuadorean respondents took place in Ecuador, in sites ranging from classrooms to homes, from city to countryside. Interviewers were two North Americans fluent in Spanish and one native Ecuadorean.

Two scorers independently rated and scored the responses, either 1 (correct or intended mesage) or 0 (incorrect or answer other than intended). When differences in scoring occurred a conference was held to resolve the differences (inter-rater reliability equaled 95%).

### Results

Results are shown in Table 2 by number (and percentage) of correct responses for each of the 19 pictographs for the two groups of respondents. In order to determine whether score differences between Mexican and Ecuadorean subjects were statistically significant, the chi square statistic was calculated. Only three items achieved statistical significance: '*Mix Pesticides Safely*' (Item 2) $P < 0{\cdot}025$; '*Apply Pesticides Safely*' (Item 5) $P < 0{\cdot}001$; and '*Dispose of Pesticides Correctly*' (Item 9) $P < {\cdot}05$. Score differences in correct responses between those from Mexico and from Ecuador were otherwise slight. No pictograph was correctly identified by all respondents. The range of correct reading was from approximately 57% to 97% in the California/Mexico group, and from 45% to 95% in the Ecuador group. The presumed familiar skull and cross-bones was understood by most respondents: 97% recognition in Mexico/California and 95% in Ecuador.

High recognition rates for both groups of respondents were recorded with pictographs that portrayed application procedures, the use of protective equipment, and cleaning up procedures. These rates may well have been due to the unambiguous nature of these pictographs as well as the respondent's familiarity of the procedures.

Items 18 and 19, as noted earlier, included the word 'No' and a slash symbol intended to signify 'Do Not Reuse Pesticide Containers.' The percentages of correct recognition of these two items for both Mexico and Ecuador subjects were among the lowest (although not the lowest) recorded. Pictographs 8 and 9's intended messages were the reverse, specifically 'Dispose of All Pesticide Containers Correctly.' Chi square analyses were performed for each combination set of pictographs 8, 9, 18, and 19, for both Mexico and Ecuador subjects. No significant differences were noted. These tests provided one means to gauge possible effect of the negative symbol. However, great care has to be exercised in using such tests since conceptual differences between the sets (i.e., a positive concept versus a negative one), combined with the fact that distinct, unrelated pictographs were used, make comparisons risky.

*Table 2 Comprehension rates for 19 pictographs for respondents from Mexico and Ecuador*

| Intended message | Number | Pictograph | Mexico ($n = 33$) % Correct ($n$) | Ecuador ($n = 37$) % Correct ($n$) |
|---|---|---|---|---|
| Danger | 1 |  | 97·0% (32) | 94·6% (35) |
| Mix Pesticides Safely | 2 |  | 57·5% (19) | 89·2% (33) |
| Mix Pesticides Safely | 3 |  | 81·8% (27) | 83·8% (31) |
| Apply Pesticides Safely With Proper Equipment | 4 |  | 84·8% (28) | 86·5% (32) |
| Apply Pesticides Safely With Proper Equipment | 5 |  | 51·5% (17) | 94·6% (35) |

*Table 2 (cont.)*

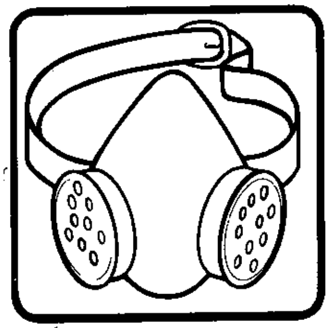
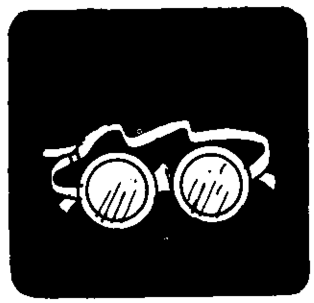
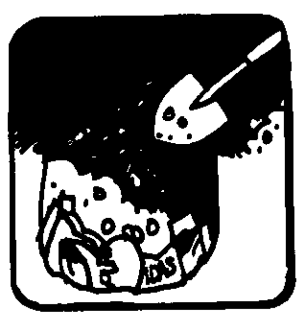
| Intended message | Number | Pictograph | Mexico ($n$ = 33) % Correct ($n$) | Ecuador ($n$ = 37) % Correct ($n$) |
|---|---|---|---|---|
| Wear Protective Equipment When Using Pesticides | 6 |  | 84·8% (28) | 81·1% (30) |
| Wear Protective Equipment When Using Pesticides | 7 |  | 90·1% (30) | 78·4% (29) |
| Dispose of all Pesticide Containers Correctly | 8 |  | 69·7% (23) | 54·1% (20) |
| Dispose of all Pesticide Containers Correctly | 9 |  | 78·8% (26) | 45.9% (17) |
| Wash Clothing After Using Pesticides | 10 |  | 78·8% (26) | 81·1% (30) |

*Table 2 (cont.)*

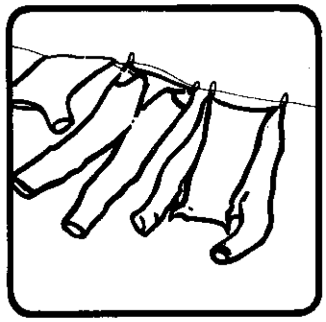
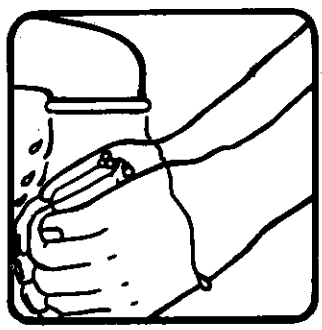
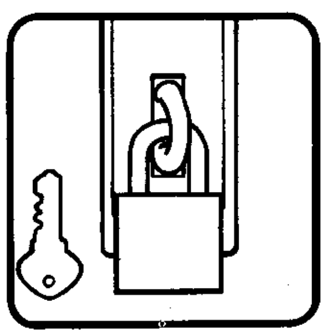
| Intended message | Number | Pictograph | Mexico ($n$ = 33) % Correct ($n$) | Ecuador ($n$ = 37) % Correct ($n$) |
|---|---|---|---|---|
| Wash Clothing After Using Pesticides | 11 |  | 63·6% (21) | 62·2% (23) |
| Wash Self Properly After Using Pesticides | 12 |  | 81·8% (27) | 86·5% (32) |
| Wash Self Properly After Using Pesticides | 13 |  | 84·8% (28) | 78·4% (29) |
| Lock and Store Pesticides in a Safe and Secure Place | 14 |  | 57·6% (19) | 75·7% (28) |
| Lock and Store Pesticides in a Safe and Secure Place | 15 |  | 72·7% (24) | 81·1% (30) |

*Table 2 (cont.)*

| Intended message | Number | Pictograph | Mexico ($n$ = 33) % Correct ($n$) | Ecuador ($n$ = 37) % Correct ($n$) |
|---|---|---|---|---|
| Read Instructions Before Using | 16 |  | 87·9% (29) | 78·4% (29) |
| Read Instructions Before Using | 17 |  | 84·8% (28) | 70·3% (26) |
| Do Not Re-use Pesticide Containers | 18 |  | 63·6% (21) | 56·8% (21) |
| Do Not Re-use Pesticide Containers | 19 |  | 75·8% (25) | 64·9% (24) |

## Study 2: Positive and negative symbols

In order to test the readability of symbols bearing both intended positive and negative meanings a set of six symbols was developed and tested. A symbol was defined as graphic configuration meant to convey meaning and used to provide information by representing a command, e.g., 'Do This' or 'Don't Do This' (Barnard and Marcel, 1984). Since many of the messages found on pesticide labels and manufacturers' literature are in the form of commands, it was thought that attempts should be made to understand the communicability of symbols *cum* commands. Furthermore, since many of the commands are negative, i.e., 'Don't Do This,' attention was given to the success in conveying the negative message.

### Materials, methods and subjects

The same 37 Ecuadorean respondents who participated in Study 1 were presented with six symbols intended to communicate positive ('Do This') and negative ('Don't Do This') commands. These symbols were of identical size, format and construction to the other pictographs (Table 3). The six symbols used were: SI (Yes in Spanish); NO; a thumbs up symbol (meaning 'Yes, Do This'); a thumbs down symbol (meaning 'No, Don't Do This'); circle with slash (or eleven o'clock circle) and a large X (also meaning 'No, Don't Do This'.) Respondents were asked to read and interpret the symbols and to respond to them stating their meaning. They were told that the researchers were interested in symbols and pictures in relation to the safe use of pesticides and that there was no single correct answer. Responses, in Spanish, were recorded as spoken, as accurately as possible. Two North Americans fluent in Spanish and an Ecuadorean performed the test procedures.

### Scoring

Two scorers independently rated the responses as either correct (or intended message) or incorrect (or answer other than intended message). Inter-rater reliability was 100%.

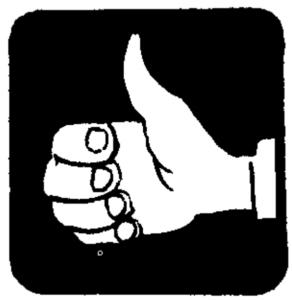
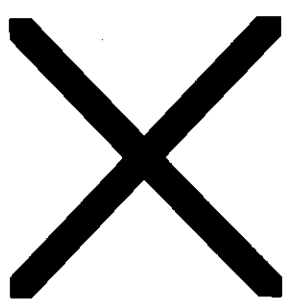
### Results

Table 3 presents the results by percentage and number of correct responses. Only the scores for the SI and NO symbols were recognized by more than half of the respondents. All other symbols were neither well recognized nor understood. The thumbs up and thumbs down were consistently unrecognized, usually being interpreted as having to do with wearing gloves when applying pesticides. The large X, although commonly used in Ecuador to signify 'No', was also not widely recognized. Despite the fact that the eleven o'clock circle is increasingly used to communicate 'Don't' (as in Don't Park, Turn, Smoke) in Ecuador, it was not well recognized (27% correct response rate).

It is clear that if symbols such as these are to be effectively used their meanings or significance will have to be taught. Since all respondents were from rural areas and had limited formal education (average third grade education) and limited literacy skills, it is likely that such symbols are of little usefulness. It is possible that respondents with greater exposure to visual and graphic media would exhibit higher rates of recognition, but educators, communicators and others cannot take it for granted that symbols mean what they think or intend them to communicate. Individuals need not only to learn to read words and sentences, but most also need to learn to read pictures.

A shortcoming of this small study was that symbols were presented alone, and were not linked to any message or picture. It could be argued that had these symbols been linked to realistic pictures, then they would be more effective at carrying and communicating their intended messages. Study 3 addressed this point. Can positive and negative

*Table 3. Recognition rates for positive and negative symbols*

| Symbol | Message | Correct recognition rates % (*n*) |
|---|---|---|
|   | SI | 92% (34) |
|   | NO | 92% (34) |
|  | Thumbs up | 22% (8) |
|  | Thumbs down | 14% (5) |
|  | Eleven o'clock circle/slash | 27% (10) |
|  | Large X | 43% (16) |

$n = 37$

symbols, when combined with pictures common in the area of safe use of pesticides, be understood and interpreted by their intended audience?

## Study 3: Pictures and positive and negative symbols

Study 3 tested whether realistic pictures depicting correct and incorrect use of pesticides could be read by peasant farmers and farm workers who regularly use chemical pesticides. This study combined drawn pictures with positive ('Do This') and negative ('Don't Do This') symbols as the means to convey specific messages related to the safe and proper use of pesticides.

### *Subjects*

Ninety-eight respondents from throughout rural areas of Ecuador volunteered to be the subjects in this study (71 males and 27 females aged from 12 to 74). The median educational level was less than the sixth grade. Fewer than 10% of the respondents did not use pesticides on a regular basis.

Two separate sets (A and B) of 22 pictures each were used. The pictures were black and white line drawings, approximately 15 × 25 cm. In each set, two different correct procedures or behaviours and their correlated incorrect procedures or behaviours were illustrated (Figure 1). Set A Correct messages were: 'Apply pesticides correctly using proper equipment and clothing' and 'Mix pesticides correctly using proper equipment and clothing'; Set B Correct messages were: 'Dispose of unused pesticides and containers correctly by burying them' and 'Clean up and wash thoroughly after using pesticides'. The correct behaviour for each message was illustrated by a Base Positive Picture, with no added symbol. Two other correct pictures, identical to the base picture but with the addition of the symbol SI and the symbol 'thumbs up', completed the positive pictures for each set. Incorrect methods of applying pesticides and mixing pesticides (Set A) and disposing of pesticides and cleaning up (Set B) were illustrated. A Base Negative Picture, with no symbol added, was created for each of the four mesages. Seven other pictures per message were prepared with negative symbols: NO, a large X printed lightly over the picture; a small skull and cross-bones imprinted at the bottom of the picture; a large skull and cross-bones lightly printed over the picture; a 'thumbs down' printed at the bottom of the picture; a small eleven o'clock circle slash printed below the picture; and a large eleven o'clock circle slash lightly printed over the picture. (Figure 2 illustrates a complete complement.)

### *Method*

All interviews were conducted in Spanish and in settings ranging from classrooms to homes to fields by two North Americans fluent in Spanish. The 98 respondents were randomly assigned to 'read and respond' to either Set A or B. A coin was flipped to determine which set to use with the first respondent of every pair; the second viewed the remaining set. Before each respondent began, the set of 22 pictures was shuffled so as to assure randomness in order of presentation. A variation on the *Q*-sort methodology (Kerlinger, 1973) was used to respond to the picture. Respondents were instructed to look at the pictures in the set and to sort each into one of three piles or groups: a correct pile (i.e., the picture portrays a correct or proper way to deal with pesticides); an incorrect pile (i.e., the picture illustrates an incorrect or improper way to deal with pesticides); and an undecided pile (i.e., if they did not understand the message or were undecided about whether the method was correct or incorrect).

### *Scoring*

A perfect 'score' was placement of the six correct positive pictures in the correct pile and placement of the 16 incorrect or negative pictures in the incorrect pile. If pictures were placed in the undecided pile, respondents were asked what they were unsure about or what they did not understand. Any answers or explanations were noted on the score sheet. After each respondent was finished sorting the pictures, the number affixed to the back of each picture was noted on a scoring sheet as to whether it had been sorted into the correct, incorrect, or undecided pile. The sort for each respondent was later compared to the intended scores and any differences noted.

### *Results*

Results are presented in Table 4 by number and percentage.

No picture was correctly recognized by all respondents. The highest percent correct recognition was registered for the Dispose picture in combination with the 'thumbs up' symbol (92%). The lowest recognition rate was registered for the Clean Up picture combined with the large eleven o'clock circle (48%). In general the base positive and base negative pictures alone registered the highest correct response rates. In these cases recognition rates for the base positive were higher for the Apply, Clean Up, and Dispose message areas. For the Mix message area the base negative picture received the highest recognition rate for all the base pictures (and second highest rate overall). Chi square analyses were used to determine whether or not there were significant differences in response rates between base positive and base negative pictures for each meassage area. Only in the case of the Apply message was a significant difference found ($X^2 = 30{\cdot}063$, $P < 0{\cdot}04$). Added symbols generally led to reduced correct interpretation. The addition of the word SI increased slightly the recognition rate for three of the four individual base pictures, from 2% to 4% gains. The addition of the word NO increased the rate of recognition for only one of the four base negative pictures, by 4%, and decreased the rate of recognition in two cases (by 2% and 6%). In only one other case (Dispose picture plus 'thumbs up') did the addition of a symbol increase the rate of recognition of the base pictures.

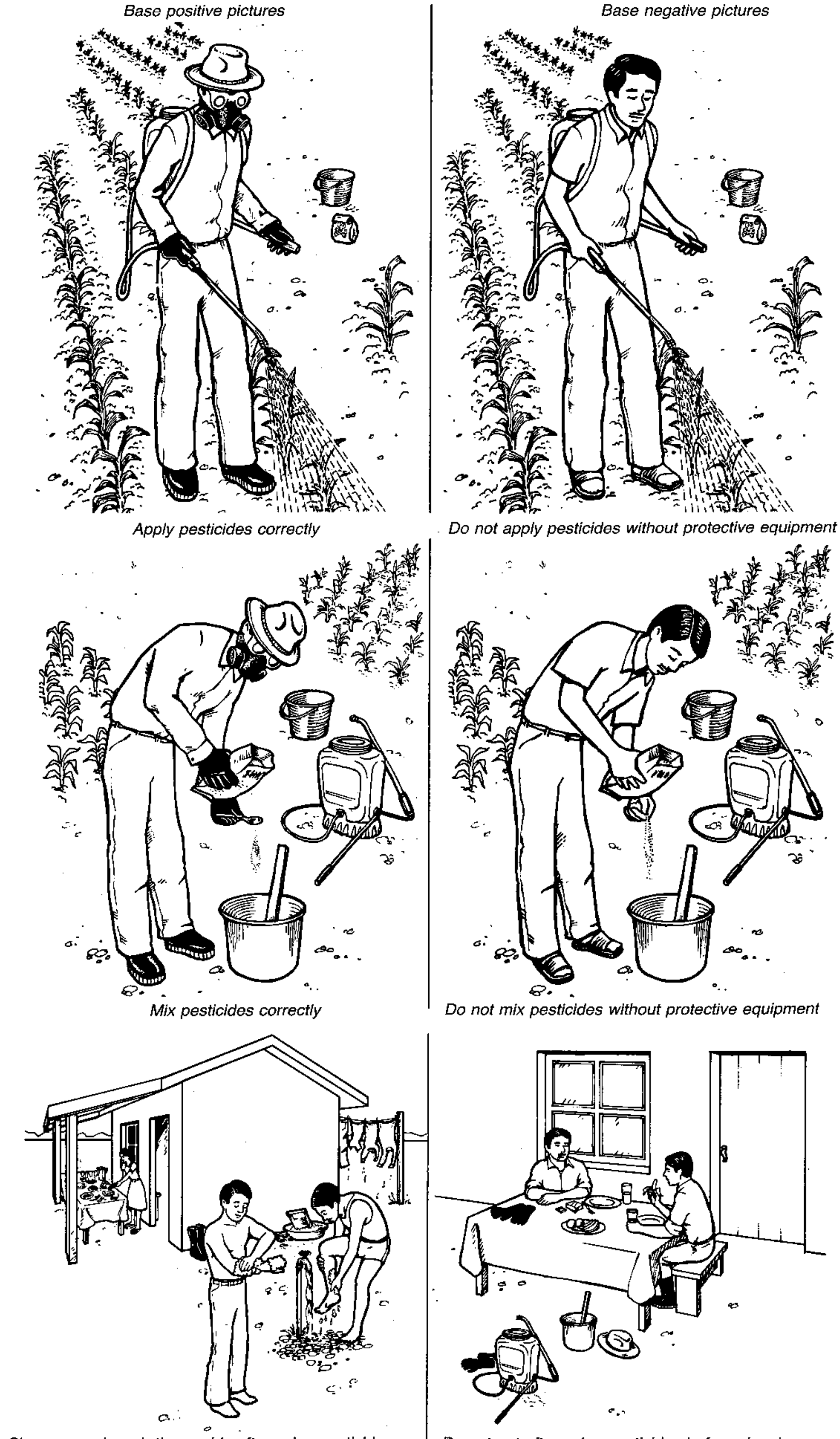
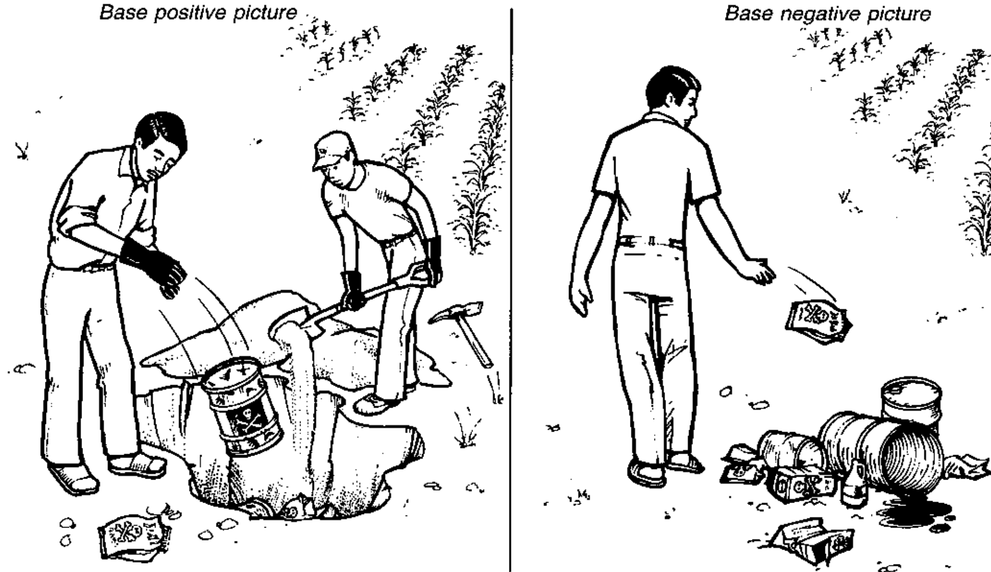



*Figure 1. Base positive and negative pictures for 4 behaviours.*

Base positive picture | Base negative picture



Dispose of unused pesticide containers by burying them | Do not carelessly throw away pesticide containers

*Figure 1 (continued).*

Addition of symbols tended to decrease the recognition rates while increasing the rates of Not Sure or Uncertain responses for both sets in both message areas for all respondents. The *N*-Par McNemar's test was used to compare response rates for each base picture with its respective positive and negative symbol pictures (Table 4). No significant differences were noted for any of the positive pictures for any of the four messages. In the case of the negative symbols, response rates were significantly lower for the large skull (compared with Apply, Clean and Dispose base negatives), for the large eleven o'clock circle (compared with the Mix base negative), and the large X (compared with the Apply base negative). The act of superimposing a lightly printed symbol over the picture generally resulted in statistically significant lower recognition rates than for the base negative pictures. Undecided responses also increased dramatically for those pictures to which a superimposed symbol was added. In fact, the addition of almost all of the symbols to the base pictures increased the rates of uncertainty, as compared to the rates of uncertainty for the base pictures alone. The sole exceptions to this result were the additions of SI or NO.

## Discussion

The original impetus for these studies came from the suggestion that pesticide labels should include pictographs as tools or aids for communicating their written messages. The three studies were designed to address the question of whether pictographs, pictures, and symbols, alone and in combination, produced by non-native illustrators, could be recognized, read and interpreted at sufficiently high rates to be effective in communicating pesticide use messages. These studies were important because of the need to develop effective methods for presenting risk information to pesticide users in relation to their decision making processes and for reducing accidental poisonings. Results indicated that no pictograph was recognized by all the viewers. Although a goal of 100% recognition is unrealistic, recognition rates may well have been within acceptable limits.

A review of pictographs and materials used reveals a wide range of illustration styles, degrees of abstractness, size of materials, and complexity of messages, e.g., 'Do' versus 'Do Not'. Such diversity likely impacts viewer's ability to read and understand the messages. These factors all account for uncontrolled variation. Although it would be preferable to control for these factors, the realities of testing in the field make it difficult and impractical to achieve the desired rigorous standards. Also, respondents represented a wide cross section of experience, educational level, and cultural background, while also representing the cross section of pesticide users in Mexico and Ecuador. Respondents' differences in perceptual abilities, ability to process information, and visual literacy levels probably all combined to affect the rates of recognition. Therefore, the recognition rates recorded may be within an expected range.

The dimensions mentioned above, especially that of visual literacy, can be altered. Individuals can learn and can be taught to decipher more complex pictures and symbols (Luyendijk, 1981). At the same time, the pictures themselves can be prepared to minimize differences in perceptual ability and visual literacy. This is an aim of pretesting visual communication materials—to make them more comprehensible, acceptable, and attractive (Bertrand, 1978; Haaland, 1984).

The results provide lessons for communicators. Using symbols both familiar and unfamiliar to the users seemed to create confusion more than clarification. This effect was particularly true when symbols were printed over the base pictures in Study 3. For example, the skull and cross-bones and the eleven o'clock circle symbols appeared to be barriers to, as opposed to aids for, conveying intended messages.

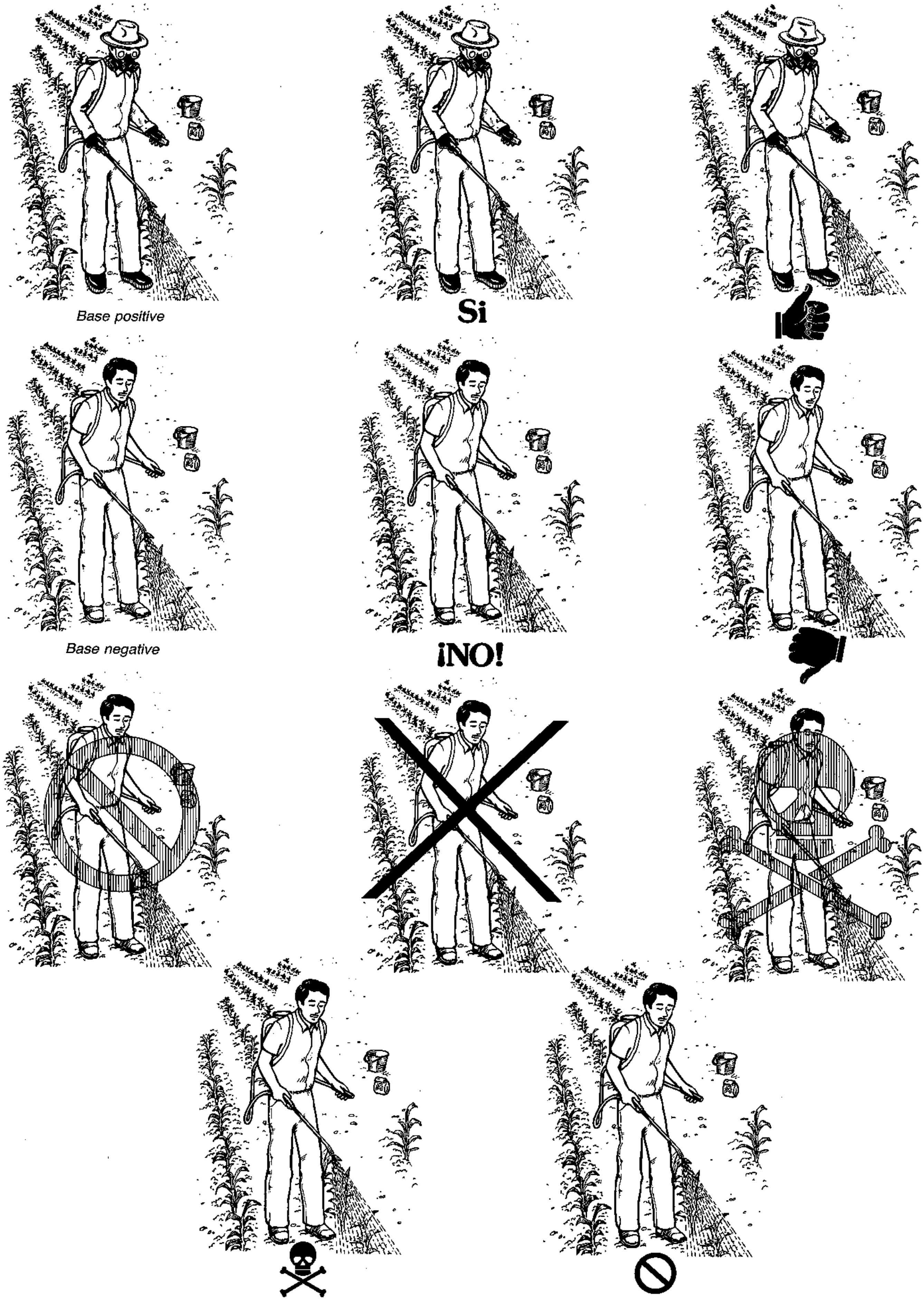



*Figure 2. Complete complement of pictures and symbols for 'apply pesticides correctly using proper equipment and clothing'.*

*Table 4. Rates of recognition for four message areas for various forms of pictures and symbols*

| Symbol | Set A (Apply) $n = 50$ Recognized | Set A (Apply) $n = 50$ Not sure | Set A (Mix) $n = 50$ Recognized | Set A (Mix) $n = 50$ Not sure | Set B (Clean) $n = 48$ Recognized | Set B (Clean) $n = 48$ Not sure | Set B (Dispose) $n = 48$ Recognized | Set B (Dispose) $n = 48$ Not sure |
|---|---|---|---|---|---|---|---|---|
| Base positive | 88% (44) | 2% (1) | 82% (41) | 4% (2) | 77% (36) | 2% (1) | 83% (40) | 4% (2) |
| SI | 88% (44) | 2% (1) | 86% (43) | 2% (1) | 79%‡ (37) | 2% (1) | 85%‡ (40) | 6% (3) |
| Thumbs up | 86% (43) | 4% (2) | 82% (41) | 6% (3) | 77% (37) | 6% (3) | 92%‡ (43) | 4% (2) |
| Base negative | 72% (36) | 6% (3) | 90% (45) | 2% (1) | 72%‡ (34) | 6% (3) | 77%‡ (36) | 9% (4) |
| NO | 72% (36) | 2% (2) | 84% (42) | 2% (1) | 70%‡ (33) | 9% (4) | 81%‡ (3) | 9% (4) |
| Thumbs down | 76% (38) | 4% (2) | 84% (84) | 4% (2) | 69%‡ (32) | 9% (4) | 70%‡ (33) | 9% (4) |
| Large skull | 54%† (27) | 26% (13) | 66% (33) | 20% (10) | 56%† (27) | 31% (15) | 54%† (26) | 35% (17) |
| Small skull | 74% (37) | 8% (4) | 82% (41) | 4% (2) | 64%‡ (30) | 13% (6) | 70%‡ (33) | 13% (6) |
| Large eleven o'clock circle | 64%† (32) | 22% (11) | 68%† (34) | 22% (11) | 48%† (23) | 25% (12) | 50% (24) | 31% (15) |
| Small eleven o'clock circle | 76% (38) | 4% (2) | 82%† (41) | 6% (3) | 70% (33) | 6% (3) | 66%‡ (31) | 13% (6) |
| Large X | 68%† (34) | 20% (10) | 80% (40) | 8% (4) | 65%¶ (30) | 20% (9) | 57%§ (27) | 30% (14) |

† Difference from base picture statistically significant by *N*-PAR McNemar's Test ($P < 0{\cdot}05$).
‡ $n = 47$
¶ $n = 46$

With the exception of the words SI and NO, adding symbols confused the viewers. Even in the cases of SI and NO, these words only slightly increased (by 2% to 4%) the recognition rates of the pictures. This finding raises questions about the guideline offered by Fussel and Haaland (1975) to add a few simple words to pictures in order to increase comprehensibility.

Results from Study 1 (particularly with pictures 18 and 19) and Study 3 (base positive compared with base negative, SI compared with NO, 'thumbs up' compared with 'thumbs down') indicated that recognition rates for 'Do' messages generally were higher than for 'Do Not' messages. For each pair of base pictures, the base negative picture closely resembled its positive mate (see Figure 1). Differences were primarily in the elimination of safety equipment from the picture. No other information was included as cues. However, only in the case of the Apply message area did recognition rates between the positive and negative base pictures differ significantly. Although it might be expected that respondents would incorrectly interpret the base negative picture, no such result was noted. This result may have been due to the nature of the *Q*-sort methodology. In that procedure other base pictures plus symbols were included. Although the pictures were shuffled prior to presentation, the inclusion of seven other base negative plus symbol pictures may have created many opportunities for respondents to receive informational cues (in the form of the negative symbols), thereby influencing responses. However, one might also argue that given the presence of so many other potential informational cues the recognition rates for the base negative picture should have been much higher. A potentially fairer test would be to include an equal number of base negative plus symbol pictures as with the base positive pictures. The issue of negative messages and the manner of their portrayal is still unresolved. Artists who drew the pictures, as well as others who brainstormed concepts for the 'Do Not' pictures, frequently commented on the difficulty of visually conveying intended messages of 'not doing something'. Results that suggest viewers of negative pictographs are confused, along with the fact that many label and advertising messages are negative (e.g., 'Do Not Apply Near Animals or Children', 'Do not Touch', 'Do Not Apply on Windy Days'), indicate that much more needs to be done if the effective portrayal of a behaviour not to be practiced is to be achieved.

The issue of size of pictographs and their incorporation of pesticide labels creates several unique problems. The relatively small size of many labels may preclude the placement of visual aids, such as pictographs, on them‡. Secondly, since labels are legal documents and specifications are often clear as to what may and must be included, adequate space may not be available. It may also be illegal to include pictographs on labels. In the case of Ecuador, regulations governing the sale and use of pesticides specify the content of labels, what colours must be used, and what sizes are allowable. Regulations do not permit the addition of

‡Another reality in countries such as Ecuador is that in too many cases pesticides are sold without labels, or labels are produced in English, German or Japanese. It is common for pesticides to be sold locally to the user in very small quantities in plain paper bags or wrapped in newspapers.

other materials, thereby excluding safety related pictographs and symbols. In this case, at least, regulations must be modified before visual materials can be legally added.

Despite the variety of problems inherent to the use of pictographs and visual materials, a critical need for such materials for instructing users on the safe and effective use and management of pesticides persists. The problem of pesticide poisonings and related accident will remain and increase as long as the use of pesticides continues without effective and creative efforts to educate users. If one goal of a social system is the public's safety, then it is crucial to think and act systematically to design efforts to reach that goal. Visual materials fit into an integrated communication system needed to cope adequately with the problem of pesticide poisonings. Such a system has several elements.

First, visual materials need stringent pretesting. As part of pretesting efforts, consideration of the functional roles (i.e., attentional, explicative, and retentional) to be played by pictographs is important. Testing prior to use is essential. But, attempts to communicate with pesticide users should not be left solely to the use of pictures—even pretested ones.

A communication system, in the context of pesticide users, must aim to provide multiple sources of information on risks, hazards, benefits, procedures, and alternatives associated with the use of pesticides. Visual materials to be used could include pictographs, posters, labels, and instructional guides. Bettman *et al.* (1986), in discussing a labelling system for presenting risk information about cleaning agents and drain openers, provide a model for designing one part of such a system. In this case the labelling system has four major components: advertisements, point of purchase displays, labels and package inserts. In the United States, Mexico, Ecuador, and elsewhere, a pesticide use communication system would aid in presenting risk information and in impacting users' decision processes and behaviours. Moreover, with the development of complementary materials (e.g., photonovels, posters, comic books, etc.) a more powerful and integrated communication system can be implemented.

A commitment to understanding the audiences is also a requirement. It is clear that culture and group perceptions bear on the communicability of messages as well as the methods for communicating. The need for understanding of audiences can be achieved and enhanced by formative research aimed at revealing such barriers, impediments, and resistance points (or behavioural contraints that act as obstacles to desired behavioural change) (Manoff, 1985). One example from Ecuador is illustrative.

One practical objective of the field research in Ecuador was to develop messages and methods to communicate that 'poisonings' could result from pesticide misuse. In the course of the research, it was discovered that the concept of 'poisoning' of many of the respondents differed significantly from the researchers'. For the researchers, poisoning meant mild, acute, *and* chronic poisonings, ranging from headaches, to rashes, to serious illnesses, to death. For respondents, poisoning (*envenamiento* in Spanish) meant *only* severe, acute symptoms, particularly death. The discovery of this conceptual difference (or barrier) was important. It suggested that many pesticide users accepted the mild, chronic symptoms associated with their use of pesticides as an inconvenience to be endured, and not as a poisoning or as a risk that could be avoided. Messages conveyed visually (or by other means) possibly were never received because of this barrier.

## Conclusion

The design and development of communication system for pesticide safety can use the findings from this research. It also requires the continuation of the type of research conducted, research aimed at pretesting visual communication materials and at understanding the audiences targetted. The system requires more. It needs integrated programs and the involvement of private, public, and voluntary sectors. Each sector is vital if questions of policy and action are to be decided. This system would acknowledge that enforcement strategies related to the use of pesticides (i.e., laws and regulations) are vital to the effective functioning of the system. Educational strategies and programs would also be incorporated, along with research on effective and usable protective equipment and alternatives (an engineering strategy) (Grieshop, 1984), as well as research on such topics as people's perceptions of risk (Slovic *et al.*, 1982), risk and culture (Douglas and Wildavsky, 1982), information processing (Bettman *et al.*, 1986), and social marketing (Manoff, 1986).

Without an integrated system, visuals alone will become curiosities. Educational and communication efforts in the area of risk, safety, and accidents due to pesticides alone will be ineffective. The record for successful educational efforts related to risk perception in general has not been encouraging (Douglas, 1983). However, as Douglas goes on to note, with some irony, those who criticize educational efforts as falling short also call for increased educational campaigns to alter the public's perception of risks. In the case of pesticides, there are real risks associated with their use and misuse, risks that often are not even perceived. In such a case, education can work to enhance understanding of the risks and to take action to deal with them. Although we believe in the power of educational efforts, we must not believe that education alone will solve the problems associated with pesticide use in the Third World (or elsewhere). Education can be a powerful force; it can be more powerful when effective visual materials are incorporated as means to convey messages. But, without their integration with other programs, strategies, and systems, education will not work.

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## References

BARNARD, P. and MARCEL, T., 1984. Representation and understanding in the use of symbols and pictographs. In *Information*

*Design*. R. Easterby and H. Zwaga (eds.). pp. 37–75. John Wiley: New York. pp. 588.

BERTRAND, J., 1978. Communications Pretesting. Monograph, No. 6. Communication Laboratory, Community and Family Study Center. University of Chicago: Chicago. pp. 144.

BETTMAN, JAMES R., PAYNE, J. W. and STAELIN, R., 1986. Cognitive considerations in designing effective labels for presenting risk information. *Journal of Public Policy and Marketing.* **5**, 1–18.

COPPLESTONE. J. F., 1977. A global view of pesticide safety. In *Pesticide Management and Insecticide Resistance*. D. L. Watson and A. W. A. Brown (eds.). pp. 147–155. Academic Press: New York. pp. 638.

DOUGLAS, M., 1983. Social factors in the perception of risk. Report to the Russell Sage Foundation. pp. 129.

DOUGLAS, M. and WILDAVSKY, A., 1982. *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers.* University of California Press: Berkeley, CA. pp. 221.

DUCHASTEL, P., 1978. Illustrating Instructional Texts. *Educational Technology.* **18**(11), 36–39.

FUSSEL, D. and HAALAND, A., 1975. *Communicating With Pictures.* Tribhuvan University, National Development Service: Kathmandu, Nepal. pp. 50.

GROUPEMENT INTERNATIONAL DES ASSOCIATIONS NATIONALES DE FABRICANTS DE PRODUCTS AGROCHIMIQUES (GIFAP), no date. Posters—Guideline for the Safe and Effective Use of Pesticides; Guideline for Emergency Measures in Cases of Pesticide Poisoning.

GROUPEMENT INTERNATIONAL DES ASSOCIATIONS NATIONALES DE FABRICANTS DE PRODUCTS AGROCHIMIQUES (GIFAP), 1986. *The Estimation of Pesticide Poisoning. The Need for a Realistic Perspective.* International Group of National Association of Manufacturers of Agrochemical Products. Bruxelles, Belgium. pp. 6.

GORE, P. H. and SLEIGHT, T., 1982. Pesticides and Peasants: They Don't Mix. *The Rural Sociologist.* **3**, 98–101.

GRANOVSKY, T. A., HOWELL, H. N. Jr., HEEP, C. L. and GRIESHOP, J. I., 1985. *Training Program for Pesticide Users.* Consortium for International Crop Protection and the Agency for International Development. Berkeley, CA. pp. 210.

GRIESHOP, J. I., 1984. Strategies of education, enforcement and engineering to improve pesticide management and safety. *Tropical Pest Management.* **30**(3), 282–290.

HAALAND, A., 1984. *Pretesting Communication Materials.* UNICEF: Rangoon. pp. 85.

INTERNATIONAL PLANT PROTECTION CENTER (IPPC), 1983. *INFOLETTER.* Pesticide Packaging and Communication, No. 58.

KERLINGER, F. N., 1973. *Foundations of Behavioral Research*, 2nd edition. Holt, Rinehart and Winston, Inc.: New York. pp. 741.

LUYENDIJK, G., 1981. *Perception Studies and the Use of Visual Materials in Nonformal Education in Developing Countries.* Center for the Study of Education in Developing Countries: The Hague. pp. 46.

MANOFF, R. K., 1985. *Social Marketing: New Imperative for Public Health.* Praeger: New York. pp. 293.

SLOVIC, P., FISCHOFF, B. and LICHENSTEIN, S., 1982. Characterizing perceived risk. In *Perilous Progress: Managing the Hazards of Technology* (eds.). pp. 91–125. R. W. Kates, C. Hohenemger and J. P. Kasperson. Westview Press: Boulder, CO. pp. 489.

VANHEEMSTRA, E. A. H. and TORDOIR, W. F. (eds.), 1982. *Education and Safe Handling in Pesticide Application.* Proceedings of the Sixth International Workshop of the Scientific Committee on Pesticides of the International Association in Occupational Health. Buenos Aires and San Carlos de Bariloche, Argentina. March 12–18, 1981. *Studies in Environmental Science* **18**. Elsevier, New York. pp. 302.

WASILEWSKI, A., 1987. The quiet epidemic. *The IRDC Reports* **16**(1): 18–19. The International Development Research Center: Ottawa, Canada.

WORLD BANK/JOAN DAVIES, no date. Poster (untitled but on Safe Use of Pesticides). Office of Environmental Affairs, World Bank, Washington, D.C.

WORLD HEALTH ORGANIZATION, 1978. *Multilevel Course on the Safe Use of Pesticides and on the Diagnosis and Treatment of Pesticide Poisoning.* World Health Organization, Geneva. pp. 126.