THE DEPARTMENT OF AGRICULTURE'S EXPERIENCE IN THE PREPARATION AND USE OF SLIDE-FILMS*

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The preparation and distribution of 35-mm. slide-films was first undertaken by the Department of Agriculture in 1926. The demand for these slide-films has grown with surprising rapidity. Last year 11,200 positives were sold from the Department's negatives. The interesting thing to note in this connection is that during the same period the demand for the glass lantern-slides of the same subjects dropped to such a low level that the Department no longer feels justified in preparing lantern-slide sets of its new lectures.

To increase the availability of its illustrated lectures on slide-films, the Department annually lets a contract to some commercial concern for the production of its negatives and the production and distribution of its positives. The low price established for these slide-films has undoubtedly been an important factor in getting people to use them. The present price of a slide-film having no more than 48 frames is 50 cents. The lecture notes to accompany the slide-film are supplied free.

Production Problems.—The production of high-grade slide-films involves a number of technical difficulties not inherent in making glass slides. From a practical point of view the big problem of making a slide-film is how to copy a series of illustrations of various kinds and sizes in a single film so as to maintain uniformly high quality in the reproduction of full-tone photographs and good legibility in drawings, charts, and reading matter. The difficulties involved in the Department's work are made more complicated by the requirement that the negative must be sufficiently uniform in printing density to permit its being run in a motion picture printer on one light.

The ideal condition for best results is, of course, to have all copy of such size as to require the same amount of reduction. As we have found it impracticable and too expensive under our conditions to do this, we make the most of our situation by concentrating our efforts upon the quality and format of the original copy. We prefer photographs rich in detail and halftones and having normal contrast. Prints that are contrasty or have large areas of highlight are least satisfactory. With the exception of prints on which handwork is required, all prints are made upon glossy paper and ferrotyped. The prints are dry mounted upon black cardboard, 9 × 11 inches in size.

Size of Copy and Picture Aperture.—The writer believes that real progress in the improvement of slide-films can not take place until a larger size of picture aperture is established as standard. The present standard 35-mm. aperture is

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too small and it will be only a matter of a relatively short time before a larger size will be used. The limitations imposed by the small picture aperture greatly increase the difficulties involved in preparing the copy and making the negatives.

Reproduction of Detail.—The value of many of the slide-films prepared by the Department of Agriculture depends largely upon the satisfactory reproduction of detail in the original photographs. A little thought will make it clear that an excessive degree of reduction of fine detail in the original will compress the details to such an extent as to exceed the resolving power of the emulsion of the film. Therefore, under present conditions it is especially desirable to avoid the use of large prints when the reproduction of fine detail is important. When the subject permits, it is well to trim down large prints and thus obtain better detail. Trimming is also highly useful in eliminating nonessentials and thus giving emphasis to the real subject of interest.

When trimming prints, when it is possible to do so, it is always advantageous to trim to the same format as that of the picture aperture. The advantages are that it affords the maximum size of negative image and, in addition, a more pleasing screen image because the photograph extends to the edge of the frame.

Legibility: Its Importance and How to Obtain It.—All the Department's slide-films contain more or less reading matter, and many contain charts and drawings; it is this type of material that gives us our most serious problems. The work is done on the assumption that if the screen image is not easily legible it is of little educational value. For this reason we constantly strive to get our coöperators to simplify and clarify their drawings, charts, *etc.*, and to get our artists to keep down the size of the drawings and make the lines and lettering heavy and bold.

Legibility of Black-and-White Copy.—The problem of preparing black-and-white copy that will reproduce well in slide-film form is a very real one, so much so that the Bureau of Agricultural Economics has found it necessary to prepare two series of charts, one for publication and another for use in slide-films. Thus, we have found by experience that copy that is well adapted for publication will often not be satisfactory for slide-films.

In general, we have found that to attain legibility on the screen it is necessary to limit the material to about 30 to 35 words, with 50 as the extreme limit. It may be of interest also to note that tests indicate that the width of a line of printed matter should not exceed 28 or 30 letters and spaces for good legibility. More definite information along these lines for the guidance of those preparing copy is much needed, and it is to be hoped that some qualified agency will undertake such studies.

Lettering and Printed Matter.—The legibility of charts, reading matter, *etc.*, naturally depends largely upon the copy, and merits much more study than has been given it. It is our opinion that hand-lettering is too slow and expensive, and, it should be added, too frequently lacking in legibility. Ordinary typewritten material should not be used, except in emergency. A small hand printing press is most satisfactory, and the use of type should be encouraged. It is doubtful whether there is any other practical process which will afford the legibility, variety, and quality at a given cost that can be attained with type. It may be interesting to know that the drafting section of the Bureau of Agricultural Economics is now using a hand-press for printing most of the lettering used on their

statistical charts. The printing is done upon a fine grade of tissue paper, which is treated by a commercial process. The printed matter is cut up and pasted to the chart. The advantage of the method is that it practically does away with blocking out the negative, *etc.*, in addition to reducing the cost and time required to do the lettering.

Most persons prefer white on black, rather than black on white lettering for slide-films. Many of our white on black illustrations have been hand-lettered with Chinese white, to which is usually added a little glycerin. When fresh, this kind of lettering is quite satisfactory, but unfortunately the Chinese white is easily rubbed off. Information is needed on how to overcome such difficulties in hand-lettering.

Printing with white ink upon black paper can be successfully done, but requires more than usual care and skill. A simple and satisfactory method suggested by J. I. Crabtree has been used with satisfaction. It consists in printing with black ink upon a gaslight paper such as Azo, then exposing the paper to light, developing, and then removing the ink with gasoline or benzine.

Shape of Aperture.—Another matter that merits attention is the shape of the picture aperture. Rounded corners may be all right for motion pictures, but they certainly are not suitable for slide-films. The truth of this statement is at once apparent when the subject is a narrow vertical photograph placed at one side of the frame, as is often done to make use of the remainder of the space for lettering. If such copy is made to fill the frame, the outer corners of the photograph are rounded and the inner ones are square. This can be overcome by decreasing the size of the image, but that is an unsatisfactory solution of the problem. The corners of the aperture should be square, or but slightly rounded.

Negative and Positive Problems.—Since the miniature camera came into its own, the importance of graininess is quite fully recognized, and considerable research work has been done on the problem. But more work should be done with special application to slide-film making. Much that has been learned about the production of fine-grain miniature negatives applies also to slide-films. However, we must not lose sight of the fact that although the typical low-contrast miniature negative may be quite suitable when used in a condenser type of enlarger for making a print on a rather contrasty grade of paper, yet a similar slide-film negative will very likely give poor results when printed upon positive film for projection purposes. The uses to which the two kinds of negative are adapted are quite different, and it is evident that if each is to serve its purpose most effectively they must differ in density and gamma. Here is an opportunity for the research worker to come to the aid of the practical worker in this field who needs more definite information upon the kind of negative required for best results and how to attain them. In addition, we need information on the type of positive that will give the most satisfactory results in a projector using a 50-watt lamp, a 100-watt lamp, *etc.* At present no one seems to know.

In addition to the problems already discussed, we have those of fog, halation, and lack of precise definition. Fog and poor definition are usually the result of defective equipment, or carelessness, or both. Two questions are pertinent here: (*1*) what type of lens is best suited to this kind of work, and (*2*) what is the best method of obtaining precision focusing? Upon the subject of halation it may be said that, judging from experience in making lantern slides, we can not expect to

attain the best results until we take to the use of non-halation films, both negative and positive. It is also believed that the films now commonly used in the production of slide-film negatives are not the best for the purpose. It would be a great help if some practical method could be devised for treating these films so as to reduce to a minimum the scratching which under present conditions takes place rapidly. Needless to say there is a growing demand for slide-films in color.

Projection Problems.—As previously stated, it is the writer's belief that the development of slide-film work has been much retarded because of the size of the picture aperture chosen as standard by those who pioneered the work. The choice made was a natural one. Nevertheless it was undoubtedly a serious mistake so far as results are concerned. Those in the Department of Agriculture who have given this matter serious study are convinced, in the light of the disappointing results attained with present materials and equipment, that we can not hope to achieve the improvement desired until an aperture of larger size is established as standard. A larger width of film, such as 70 millimeters, might be the best solution, but in view of the fact that the Leica or Contax size (24 × 36 mm.) is now a standard miniature camera size the world over, that precision cameras of the highest order are now readily available, and that printers and projectors are also available, we are rather strongly inclined to believe that the Leica size of frame would be the most practical solution of the problem. A third choice might be a square picture aperture of the maximum size permissible on 35-mm. film, possibly unperforated. If the aperture were square, there would be no need of supplying the projector with a revolving front, which is an indispensable feature of any good projector for Leica slide-films. In considering this problem, however, the desirability of establishing the 2 × 2-inch glass slide as a substandard size should be kept in mind, as its development will be greatly influenced by the market supply of projectors adapted to its use. The size of the condenser that will cover a slide made on a 2 × 2-inch plate is also well suited for use in projecting 24 × 36-mm. slide-film frames.

DISCUSSION

MR. GREENE: What wattage lamp was used in Mr. Freimann's projector?

MR. FREIMANN: 200-watt, with the beaded screen.

MR. CRABTREE: Referring to Mr. Hanson's paper, I realize it must be difficult to obtain slide-films of uniform quality from submitted subject matter of varying quality. I understand that they are rephotographed or recopied in order to level up the contrast in the photographic film.

An alternate scheme would be to use duplicating positive film for the negative film in the copying camera. This film has properties such that by using either a yellow or a violet filter over the lens when copying, the contrast of the negative can be varied, even though all the images are developed for the same time. Those who are doing this kind of work may find this a very useful way of levelling up the contrasts without changing the time of development.

MR. MATTHEWS: Mention was made of scratches encountered in a good many of these slide-films after they have been used for some time, and I wonder whether varnishing the surfaces would not be worth considering as a means of overcoming that objection.

MR. MACHARG: There are several solutions on the market for that purpose.