cation of the "Principle of Increasing Risk" (discussed in Part I, Vol. XXIII, No. 5, Sept.-Oct. 1971).

Principle of Increasing Risk Example

To show how risky it is for a farmer to ignore the potential adverse consequences of a given farm plan consider the case of a farmer who with 100% equity on a 320 acre farm decides to borrow money to expand to 800 acres. Based on the investment figures in Table 1, the amount of capital that must be borrowed is $687,571 – $305,881 or $381,690. The resulting equity level is approximately 45%, ($305,881 ÷ $687,571) × 100. Further, assume that the farmer decides on the basis of the favorable return he has been earning from fall lettuce to maintain his present .20 cotton – .40 lettuce rotation. Such a reorganization should earn the farmer a much higher average income. However, it is also true that the farmer undertaking the reorganization has a correspondingly larger risk burden to bear. The farmer's capital position *before and after* reorganization, *assuming a bad year,* is summarized below:

The $319,641 Net Worth as in the before organization example is calculated as: the previous net worth ($305,881), plus the total farm returns above variable cost, minus the total farm annual cash fixed cost ($58/acre – $15/acre) × 320 acres = $13,760. The $292,281 Net Worth as in the after reorganization example is calculated as: the previous net worth ($305,881), minus the difference between the total farm annual cash fixed debt and the total farm returns above variable cost, ($75/acre – $58/acre) × 800 acres = – $13,600. Under the reorganized plan, the farmers equity following the bad year is well below the 45% level assumed at the outset and still no allowance has been made for the loss in asset value resulting from a year's depreciation on the capital assets. Again, this is a result that might follow from a very sound plan, but the point we really wish to emphasize is that in any event, the *farmer and his creditors or suppliers should be fully aware of the potential results both good and bad before a decision is made!*

Risk Diversification and Planning in Summary

As stated in the very first article of this series, our primary intent has been to illustrate the importance of and procedure for allowing for risk and uncertainty in crop farm planning. We hope that as a result of analyzing those few unique crops, crop combinations, and/or farm planning situations that have been presented, interested readers will be able to perform a comparable and realistic risk analysis on their own. The following outline is provided as a summary of the steps that should be taken:

1. Estimate the farm fixed costs and fixed debt burden as presented in Tables 1 and 2 of this article.
2. Estimate the per acre returns above variable and harvest costs for the anticipated crop rotation.
3. Look up the net income variability coefficient for the anticipated rotation as in Tables 1 and 2, Part II (Nov.-Dec. 1971) or as a rough approximation, calculate the desired variability coefficient as a simple weighted average of the individual crop net income variability coefficients presented in Table 1, Part I (Sept.-Oct., 1971).
4. Multiply the expected per acre returns above variable costs by 1.65 times the variability coefficient and subtract the resultant quantity from the original estimate of the returns above variable costs to derive an estimated "bad year" per acre returns above variable costs (see Part I).
5. Analyze, as in the "Principle of increasing risk analysis" presented in Part I or earlier in this article, the riskiness of the anticipated plan given the estimated fixed debt burden as in 1 above and the estimated bad year income as in 4 above.

Before Reorganization: 320 Acres @ .20 cotton – .40 lettuce assuming a bad year

Assets	–	Liabilities	=	Net Worth
$319,641	–	0	=	$319,641

After Reorganization: 800 Acres @ .20 cotton – .40 lettuce assuming a bad year

Assets	–	Liabilities	=	Net Worth
$687,571	–	$395,290	=	$292,281

Which produces the greater drift, dust or spray?

The debate has been settled in Arizona for several years. We m however, have a new generation agriculturists who aren't acquainted with the facts. The University of Arizona Department of Entomology, has removed all but a few dust formulations (eg. sulfur, cryolite) from its agricultural insect control suggestions for 1972, and it seems important to present this supporting information in a condensed version for Progressive Agriculture readers.

The facts simply stated are these:

1. Dusts drift more than sprays.
2. Dusts deposit less on the target crop than sprays.

Dusts are most useful for special coverage problems, such as dense foilage in orchards where exceptional crop depth is involved. However, the use of insecticide dusts produces a greater drift hazard than sprays and results in less active material deposited on the plants, as will be shown.

In non-agricultural situations dusts still have their place in limited areas for spot treatment against household and garden pests.

The fall-rate of small particles, and their resulting drift, depends much more on their size than their densi or shape. A fine spray drifts as f as fine dust, and perhaps further if the droplet continues to evaporate and diminish in size during its flight. However, sprays can be made coarse and consequently have the advantage.

The U.S.D.A. Agricultural Handbook No. 287 (1965), "Aerial Application of Agricultural Chemicals," contains the following:

"The average particle size of dusts is considerably smaller than that of sprays. Dusts, therefore, tend to drift further than sprays. If there is a choice between dusts or sprays, always use sprays to reduce drift hazards."

Dust diluents, which carry the active insecticide, are ground into very small particle sizes ranging from 1 to 30 microns in diameter, but usually less than 10. For instance, the average diameter of Celite® (diatomaceous earth) is from 4 to 9 microns. The average diameters in microns for the more common silicate diluents are: Vermont talc 3.8; Pyrax ABB® 3.5; Brunswick clay (N.J.) 1.3; Cherokee

Trade names used in this article are for identification only and do not imply endorsement of products named or criticis of similar products not mentioned.

*by George W. Ware**

Pesticide Drift . . . Dust vs. Spray

Table 1. Drift Pattern in Relation to Particle Size*

Drop Diameter (Microns)	*Particle Type*	*Feet particle drifts in 3 MPH Wind while falling 10 feet*
400	Coarse aircraft spray	8½
150	Medium aircraft spray	22
100	Fine aircraft spray	48
50	Air-carried sprays	178
20	Fine sprays and dusts	1,109
10	USUAL DUSTS and aerosols	4,436
2	Aerosols	110,880

**Modified from, "Principles of Plant and Animal Pest Control," Vol. 3, Insect Pest Management & Control Natl. Acad. Sci. Pub. 1965, 1969.*

clay (Ga.) 1.1; Type 41 kaolin (S.C.) 0.6; Attaclay® (Ga.) 1.9; and Diluex® (Fla.) 1.7.

One Arizona insecticide formulator purchases his dust diluents with the specification that 92% of the particles have a mass median diameter of 5 microns or less.

For sprays, a wide range of chemical formulations is available, and the droplet particle size can be altered to fit application needs. In agricultural spray discharge droplets from 50 to 300 microns in diameter are most commonly found, with an average size of 180 microns recommended (Akesson, 1949). Brown (1951) indicated that the optimum droplet size for coverage by ground rigs was from 80 down to 30 microns in diameter. For aerially applied sprays, falling from 5 to 25 feet, a larger droplet size of 70 to 100 microns was desirable to counter the turbulence produced by vortex and prop wash.

Table 1 gives the relative droplet and particle sizes for sprays and dusts and their air-borne or drift characteristics.

Do dusts drift more than sprays? Drift studies of spray versus dust were conducted by Paul Gerhardt and Jim Witt, of the Department of Entmology, University of Arizona, in 1961-62. Their data were taken from alfalfa samples collected downwind from standard aerial applications to the alfalfa. When comparisons were made the materials were applied simultaneously by commercial aerial applicators. Drift values were calculated from residue analyses of alfalfa samples.

Six complete and detailed studies were made using DDT, toxaphene, Tedion and BHC. The entire six are combined graphically in Figure 1. The rates of active ingredient applied varied from 0.5 to 4.0 pounds per acre. The emulsion sprays were applied at 7 gallons per acre, while the dusts were applied to give the same rate of active ingredient.

The composite of six series of residues (Fig. 1) indicated that at all sampling stations up to one-half mile from the application site the dusts produced much higher off-target drift residues than sprays. These ranged from a two-fold greater drift residue at 82 feet to a nine-fold greater residue one-half mile from target. In other words, a dust application may deposit nine times more residue than a spray application on alfalfa one-half mile downwind from the target area, under identical climatological conditions.

More impressive perhaps, are the residue analyses which show that the sprays deposited an average of 144 ppm of toxicant on target while the dusts deposited only 74 ppm. This points to the greater potential pest control efficiency of sprays through more deposition and less drift.

From this information it becomes obvious that pesticide dust particles are considerably smaller than conventional agricultural spray droplets. The smaller particle size of dusts results in a longer air-borne time which leads directly to greater drift, and to less deposit on target.

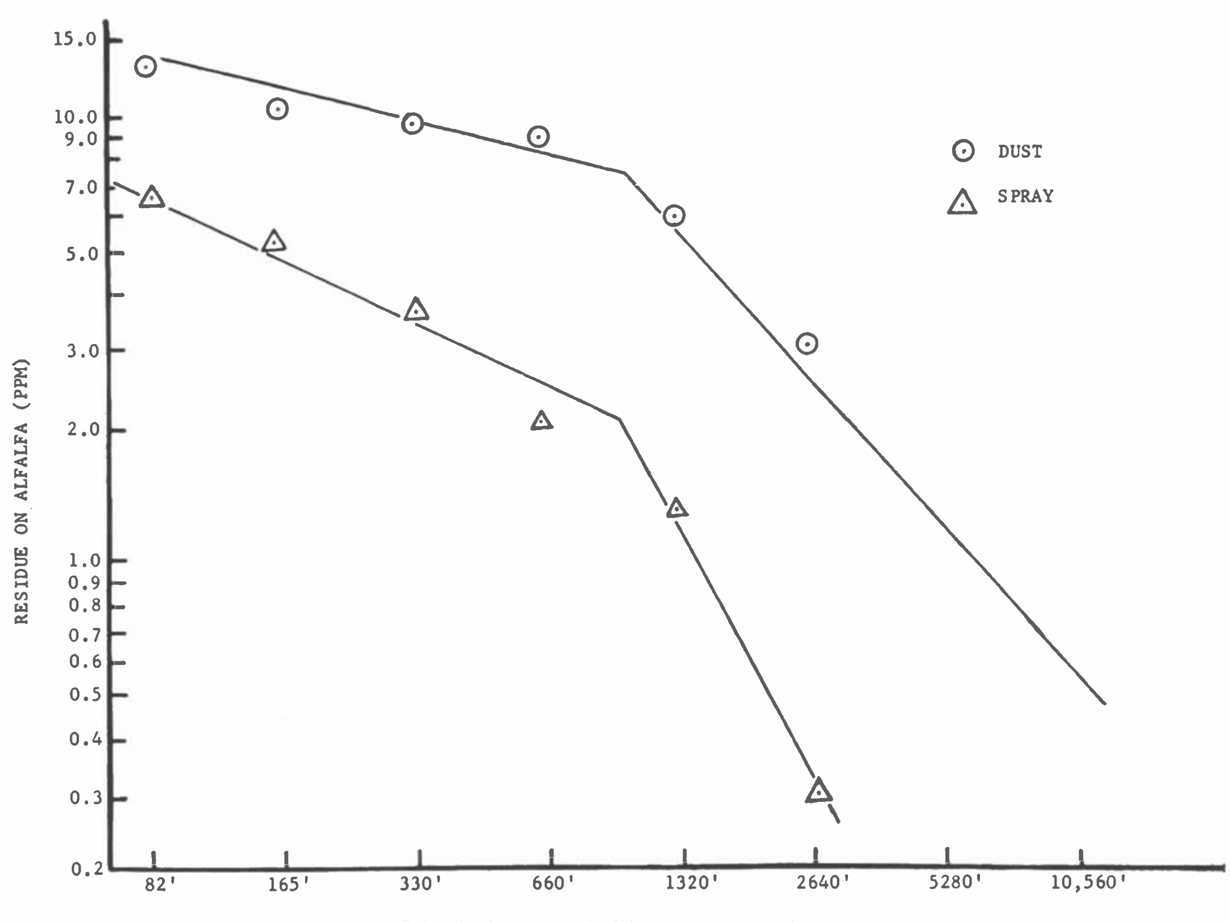

Figure 1. Comparison of insecticide dust versus spray drift onto alfalfa.

*Head, Department of Entomology.