

after cultivation. Secondly, a great quantity of food in the form of stems and leaves of plants is incorporated into the soil by cultivation which reduces the crowding effect and increases the chances of any migrating larvae to locate new feeding sites. Third, the soil predator population, although not being significantly changed (table 2), has a greater difficulty in encountering non-migrating individuals; and fourth, parasitoids are handicapped in their location of larvae or pupae in the disrupted habitat (table 3). Survival of larvae under these conditions is greatly enhanced, giving rise to maximum average yields of over 30 adults per yard-square of soil after every cultivation. Every time the cultivated soil is irrigated, some female gnats are attracted for oviposition, and their larval progeny find abundant food available.

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TABLE 1. ADULT OFFSPRING OF 250 HIPPELATES COLLUSOR FEMALES OVIPOSITING ON MILLET IN LABORATORY AND FIELD

Condition of millet at oviposition	Irrigation	Mean no. adult offspring	
		Laboratory*	Field†
Growing	Only sufficient water to sustain turgid plants	23.9	55.8
	Water-saturated soil	29.8	51.8
Mixed into soil	Only sufficient water to sustain turgid plants	70.4	186.4
	Water-saturated soil	32.3	137.0

* 6 replicates in each of 2 cages.
† 5 replicates in 5 separate field tents.

TABLE 2. MEAN NUMBER OF SOIL PREDATORS IN CULTIVATED AND NON-CULTIVATED SOIL SUPPORTING THE DEVELOPING STAGES OF HIPPELATES COLLUSOR AT THERMAL, CALIFORNIA*

Predator Group	Average no. per yard-square and depth of 6-inches†	
	Uncultivated	Cultivated
COLEOPTERA		
Carabidae		
<i>Agonoderus maculatus</i> LeConte	32.74	35.08
Staphylinidae		
Larvae	2.34	9.35
Adults	720.40	484.16
DERMAPTERA		
<i>Euborellia annulipes</i> (Lucas)	4.67	4.67
HYMENOPTERA		
Formicidae	44.44	51.44

* Weed control in the non-cultivated orchard was performed by cutting.

† Average of 10 semi-monthly sample dates from June through November 1968, estimated from 6 inch core samples with a 1 inch diameter, processed in Berlese funnels.

TABLE 3. PARASITIZATION OF HIPPELATES COLLUSOR LARVAE BY 10 HEXACOLA SP. FEMALES IN INOCULATED 236-CC CONTAINERS WITH MILLET IN CAGES AT 25°C

Condition of Millet at Oviposition	Inoculated Egg Density	Adult Hippelates Emerged		Parasite Emergence
		%	%	
Growing	50	36.4	3.2	
	100	32.5	3.8	
Tilled in soil	50	57.2	0.5	
	100	60.7	0.1	

Hybrid vigor estimates for backcross of crisscross breeding involving Angus and Hereford

CROSSES BETWEEN THE Aberdeen Angus, Hereford and Shorthorn breeds are becoming increasingly popular in the production of market calves—reflecting (in part) the impact of recently published results of experiment station trials of two-way and three-way crosses.

If a producer elects to crossbreed, he is faced with the question of how to obtain his replacement heifers. When crossing two breeds, one systematic way to obtain replacement heifers is to crisscross. Crisscrossing is a system in which a heifer sired by a bull of one of the breeds (if kept for replacement purposes) will always be bred to a bull of the other breed.

Under such a system the brood cows and calves produced after several cycles will carry about two-thirds the blood of one breed and one-third the blood of the other or vice versa. In the first backcross, however, the calves will have one-quarter the blood of one breed and three-quarters of the other, or vice versa.

First backcross

Little information has been reported to date on the amount of hybrid vigor exhibited by the first backcross calves. This report presents some such estimates. As shown in table 3, the average of the reciprocal backcross (backcross calves out of F₁ mothers) is 8.1% superior to the average of the straightbreds (straightbred calves out of straightbred mothers) for per cent calf crop weaned, and 9.7% better for pounds of calf weaned, per heifer exposed to a breeding bull. That is to say, the same genetic resources (the Aberdeen Angus and Hereford breeds) when used in this stage of the crisscross system are estimated to be about 10% more efficient than when used in straightbreeding (for traits associated with weaning).

Raw data for similar crosses of the Aberdeen Angus x Shorthorn and Hereford x Shorthorn as well as for Aberdeen Angus x Hereford breeds are presented in Tables 1 and 2.

Three calf crops were calved and reared to weaning at the University of California Sierra Foothill Range Station near Marysville. The breeding plan is shown in table 1. The breeding heifers were produced in the University of California crossbreeding trials at Davis.

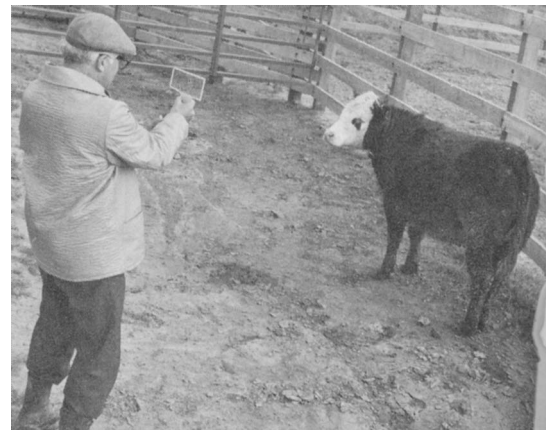
In the design of the trials, (tables 1 and 3) systematic sire and year effects cancel out in the hybrid vigor estimates presented in table 3.

Hybrid vigor

No hybrid vigor estimates are given for the Aberdeen Angus x Shorthorn or Hereford x Shorthorn crosses because of the lack of data for the third calf crop (nine breeding heifers involved in plans to produce the third calf crop were lost during the experiment through accidental poisoning). However, raw data for all of the 2-way crosses are given (tables 1 and 2) since they can yield useful information when combined with similar data from trials at other places.

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An F₁ (Angus x Hereford) heifer being scored for meatiness with rump gage.



*first
systems
breeds*

TABLE 2. UNADJUSTED WEIGHT DATA FOR STRAIGHT BRED AND BACKCROSS CALVES WEANED IN 1967, 1968, 1969

Breeding of calves*	Sex of calf†	Weight in pounds				Age in days at weaning	
		At birth	On 4/10/67	On 5/30/67	At weaning 6/28/67		
A (AA)	H	53	222	—	335	195	
	H	51	—	—	390	232	
	S	50	225	—	355	210	
	S	62	308	—	420	268	
	H	50	—	—	395	251	
	H	49	228	—	340	218	
A (AH)	H	50	235	—	358	200	
	S	55	297	365	400	250	
	H	56	226	280	315	190	
	H	60	291	365	380	254	
	H	58	273	330	365	252	
	S	58	306	380	400	240	
	S	64	270	350	370	194	
	S	63	282	360	392	228	
	S	74	274	355	390	198	
	H	56	292	365	390	249	
A (AS)	S	57	285	340	375	264	
	H	56	290	360	387	256	
	S	60	320	380	410	230	
	S	65	338	440	476	251	
	S	50	327	420	450	255	
	H	62	280	315	327	257	
	S	64	257	330	360	219	
	H	60	295	380	405	226	
	S	42	285	358	385	258	
	H (HH)	S	60	244	460	486	260
H		62	155	320	350	233	
S		69	220	422	470	242	
H		63	245	430	478	262	
H		61	160	315	342	228	
H		62	—	275	324	176	
H		68	190	344	382	225	
S		71	244	432	452	259	
H (HA)		H	78	—	274	330	149
		H	64	185	365	400	225
	H	73	230	440	480	244	
H (HS)	S	60	244	460	486	260	
	H	62	155	320	350	233	
S (SS)	S	69	220	422	470	242	
	H	63	245	430	478	262	
	H	61	160	315	342	228	
	H	62	—	275	324	176	
	H	68	190	344	382	225	
	S	71	244	432	452	259	
	S (SA)	H	78	—	274	330	149
		H	64	185	365	400	225
	S (SH)	H	73	230	440	480	244
		S	51	300	405	485	262
S (SB)	H	45	275	354	430	255	
	S	59	333	438	560	277	
S (SC)	S	51	292	390	495	228	
	S	61	310	410	490	237	
	H	50	330	448	533	250	
S (SD)	S	70	342	439	520	274	
	H	68	346	465	560	274	

* First letter in parenthesis indicates breed of sire and second letter, breed of dam. A, H, and S signify Aberdeen Angus, Hereford, and Shorthorn breeds respectively.
† S = Steer, H = Heifer.

TABLE 1. EXPERIMENTAL DESIGN AND PERCENTAGE CALF CROPS WEANED

Weaning year	Number and breed of bulls used to produce calf crop	Number and breeding of heifers* exposed to bull	Number and breeding of calves weaned	Percentage calf crop weaned
1967	1 A	8 (AA)†	7 A (AA)	87.5
		15 (AH)	13 A (AH)	86.7
		7 (AS)	5 A (AS)	71.4
1968	1 H	9 (HA)	8 H (HA)	88.9
		8 (HH)	6 H (HH)	75.0
		5 (HS)	3 H (HS)	60.0
1969	1 S	4 (SA)	4 S (SA)	100.0
		2 (SH)	2 S (SH)	100.0
		3 (SS)	2 S (SS)	66.7

* All heifers bred as 2-year-olds to calve as 3-year-olds.
† Within a parenthesis the first letter indicates the breed of sire and the second the breed of dam. A, H, and S signify the Aberdeen Angus, Hereford, and Shorthorn breeds, respectively.

TABLE 3. HYBRID VIGOR ESTIMATES FOR THE BACKCROSS IN A CRISSCROSS INVOLVING THE ABERDEEN ANGUS AND HEREFORD BREEDS

	Percentage calf crop weaned	Weaning weight of calves*	Weaning age of calves	Pounds of calf weaned per heifer exposed to bull
	%	days	lb	lbs
Average of reciprocal backcrosses, $\overline{BC} = \frac{A(AH) + H(HA)}{2}$	87.8	418.2	235.4	367.2
Average of straightbreds, $\overline{SB} = \frac{A(AA) + H(HH)}{2}$	81.2	412.2	235.6	334.7
Hybrid vigor estimate, $HV = \overline{BC} - \overline{SB}$	6.6	6.0	-0.2	32.5
HV as a percentage of SB	8.1	1.5	0.0	9.7

* Heifer calf weights adjusted to a steer calf equivalent.

CRISSCROSSING CHART FOR TWO-BREED CROSSING AS USED IN BEEF BREEDING TRIALS AT U.C. SIERRA FOOTHILL RANGE STATION.

