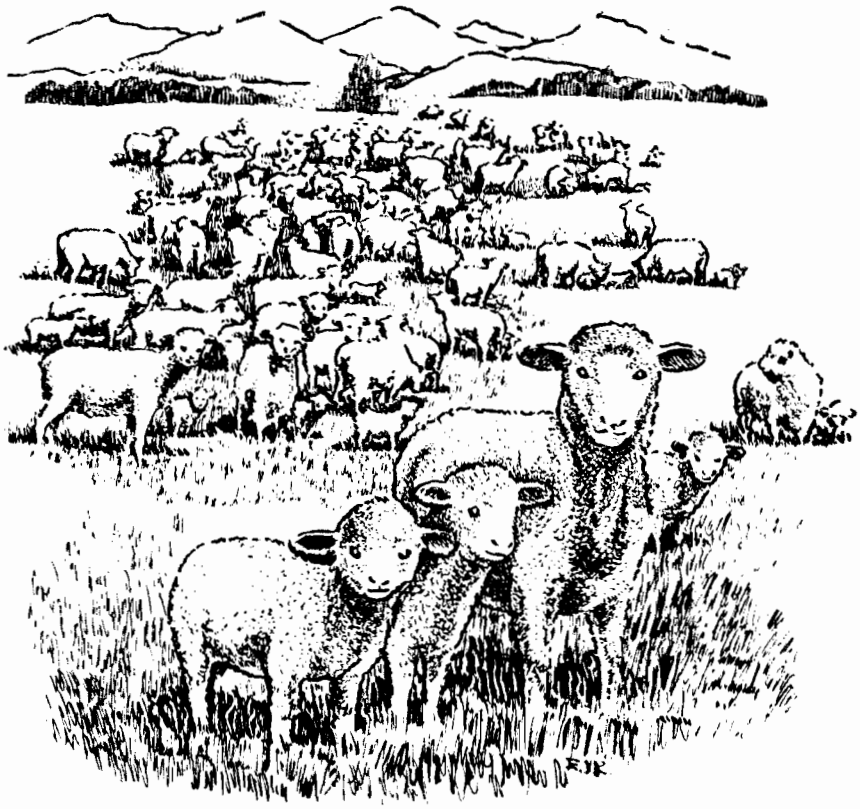
IRRIGATED PASTURE SOLANO COUNTY



Agricultural Extension Service

University of California

Solano County - Fairfield, California

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS, U. S. Department of Agriculture, University of California and County of Solano, co-operating

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PRIMARY USES

Considerable irrigated pasture in Solano County is devoted to fattening feeder lambs off clover from spring till the beginning of fall. This enterprise is largely concentrated on heavy textured soil, southeast of Dixon, and is irrigated from deep wells and Sacramento River water, (Reclamation District #2068.) Some use is made of these same pastures to winter ewes, with lambs at side, and to "flush" ewes before breeding time. A few "old crop" lambs are also fattened in the fall and winter period.

Older, more grassy pastures in the same area, have been converted to feeding stocker calves and cows with calves at side. Cattle tend to utilize the coarser feed better than sheep and it is not uncommon to see cattle and sheep grazing the same fields at the same time. This conversion to cattle has taken place, apparently because of more favorable beef prices over lamb prices, as well as the change toward more grass as the pastures have aged. Currently, more acreage is devoted to cattle grazing than is used for sheep.

Dairy springer heifers are raised to a small extent on irrigated pasture and a small number of producing dairy cows are maintained on irrigated pastures associated with commercial dairy farms. However, the large majority of lactating dairy cattle in Solano County are kept in dry lot.

SOIL REQUIREMENTS

Irrigated pasture can be successfully grown on nearly any soil in Solano County that can be irrigated properly. However, the great majority of pastures are located on marginal soils that can be levelled to an irrigation grade and flood irrigated. Class I and II soils, of medium texture and deep, permeable subsoils, are usually farmed to the highest potential income row crops - alfalfa and orchards. Class III and IV soils are most often the sites selected for irrigated pasture. These include the basin soils of predominately clay texture and the low terrace soils that have developed a clay pan under a foot or so of sandy loam top soil. In both cases, these soils possess relatively shallow "effective" depth due to the restricted sub-surface drainage. Irrigated pasture is well suited to such soil conditions, as it is relatively short rooted and better able to resist damage from impaired sub-surface drainage than most other crops.

LAND PREPARATION AND TIME OF SEEDING

Strip checks, levelled to an irrigation grade of .2 to .3 of a foot per 100 feet of run and possessing side slope ranging from zero to a maximum of .1 of a foot per 100 feet, are the most practical and efficient means of land preparation for establishing irrigated pasture in Solano County in most situations.

Sprinkle irrigation is not generally recommended when it is possible to utilize an efficient flood system. Any savings that can be realized by not having to level land are often wiped out by the additional sprinkling costs of purchase and depreciation of the sprinkling system; added power costs to put water under sprinkling pressure; and the additional labor and inconvenience of having to move sprinkler pipe. Sprinkling may be required when it is not feasible or possible to level the ground, or where there is no surface drainage outlet, or where the size of the property is small, or where only small amounts of water are available.

A proper job of levelling and final touchup after settling is most important before planting irrigated pasture. Since it is just as important to be able to get the water off the land, as well as on, provision for adequate surface drainage at the low end is also of paramount importance. Once land is seeded to pasture that is to last for seven years or more, it is too late to go back and correct any low or high spots that have developed. Because of this, it is often best to delay the planting of irrigated pasture on newly levelled land until all differential settling has occurred. A highly recommended procedure is as follows:

A. Level ground in the spring through summer period. Subsoil after levelling.
B. Plant dry land grain or hay crop in the fall.
C. Take hay or grain off as early as possible in the spring and land-plane to eliminate any low or high spots that have developed over the previous winter.
D. Install irrigation, distribution and drainage system and border checks. Be very sury that no "borrow" pits or furrows are left on each side of the levees.
E. Plant Sudan Grass (can be pastured or made into hay. If pastured - fences, lanes, stock watering devices, receiving corrals, etc., will have to be installed soon after, or before planting. If hayed - this work can be delayed until later.)
F. Plant irrigated pasture seed directly into the Sudan Grass stubble in the fall of the year, before the end of October, if possible.
G. Irrigate the pasture until the rains arrive.
H. Install any necessary fences, etc., that were not previously constructed.

The above procedure provides for land settling and eliminates many weeds by successive smother crops. Sudan grass, besides producing a maximum of useful forage, also imparts a beneficial effect to the soil. Its extensive rooting habit tends to reduce soil compaction from the levelling operation and results in land requiring little or no tillage before planting permanent pasture.

It is essential for fall planted pasture to get a good start before cold weather strikes. If planting is delayed until the cold weather arrives, the seed often germinates poorly or quite late and can also be damaged by frost and competition from agressive winter growing native plants. Spring and summer plantings also run into problems of maintenance of proper surface soil moisture and competition from aggressive summer growing weeds, such as Water Grass.

SEED AND SEEDING

I. ADAPTED PERENNIAL GRASSES

Recommended Varieties

A. Perennial Ryegrass - A non-bunching grass that is palatable to both cattle and sheep. A new strain of Ryegrass has been developed that tends to delay heading out and produces a longer growth period than earlier heading strains. It is usually quickly established and provides early green feed. It should not be confused with Annual Ryegrass that is endemic on dry land pasture and often persists in land newly seeded to irrigated pasture.

B. Orchard Grass - A bunch type perennial grass that is sufficiently palatable for cattle, but not recommended for sheep. The Akaroa strain, or one of the newer strains that delays the onset of heading over common or Palestine Orchard Grass is preferable. This grass is slow to establish itself and may take a year or more to evidence itself in a new pasture.

Not Recommended Varieties

C. Perennial Fescue Grasses- Including Alta and Goars Fescue - a vigorous, but coarse, bunch grass that grows well in wet lands and in soil possessing salt problems. The main reason for not recommending this grass is its lack of palatability to both sheep and cattle. Local experience with it has been unfavorable because it tends to clump up badly and "take over" the pasture when grazing animals avoid it and graze the more palatable feed feed "into the ground." These coarse, ever-widening clumps pose a hazard to weed mowing operations, disrupt even distribution of irrigation water and cut down on the animal gain per acre. Once it has become dominant in a pasture, it is very difficult and costly to eradicate.

D. Dallis Grass - Not commonly found in Solano County. This grass requires very hot weather, equal to that of the interior valleys to produce well.

II. ADAPTED PERENNIAL LEGUMES

Recommended Varieties

A. Narrowleaf Prostrate Birdsfoot Trefoil - This palatable legume is grown extensively in Solano County. It thrives in wet lands and moderately saline solis and withstands drought periods when these occur. It stools out and forms a tight short sod that is particularly useful in fattening lambs and in withstanding hoof marking when grazed while the ground is wet. It is particularly well known for its non-bloating characteristic, a most valuable asset, especially for cattle. It produces most of its growth in the spring, summer, and early fall months. Much of its seed is "hard" - a characteristic that allows it to re-establish itself after being drowned out for one reason or another. In short, this is a durable, useful legume that can survive and produce under many extremes of soil, weather and management.

B. Salina Clover - A selection of Palestine Strawberry Clover, especially adapted to wet lands. This clover has shown its ability to resist "drowning out" even more markedly than Narrowleaf Trefoil. It grows well with Trefoil and tends to cover ditch sides and levees and perennially wet areas better than Trefoil. No bloat has been proven on this clover, but it is not yet known whether it will cause bloat in a pure stand. Cattle and sheep graze it readily. It has been observed to "fix" nitrogen in greater amounts than most other clovers. This may stimulate grass growth adjacent to it. It tends to evidence itself markedly in the second year after seeding, being a bit slow to show the first year in many cases. It has taken three or four years to become established when over-seeded or drilled into an existing sod.

Not Recommended Varieties

C. Ladino Clover - This clover grows well, is quite palatable and is eventually found in nearly all irrigated pasture sooner or later, whether seeded or not. It is not recommended in original seed mixes because it tends to "take over" the pasture right away and often crowds out other plants, resulting in a nearly solid stand of Ladino. Such stands pose a very serious bloat problem,especially to cattle. Unexpected outbreaks of severe bloat have occurred in dairy cattle, even on old stands which had no history of bloat before. Sheep resist bloating on it, but do tend to scour badly and may contact enterotoxeima on very lush, lightly stocked Ladino pasture. Since it tends to show up even when not seeded, it appears unneccessary to include it in the original mix.

D. Erect Broadleaf Trefoil - This legume grows erect like alfalfa, does not form a protective sod, and is unable to withstand adversity in the same manner as Narrowleaf Trefoil. It usually disappears in competition with more adaptable plants on marginal soils. It is sometimes grown for "green chop" feed for dairy cattle, in place of Alfalfa. This is done mainly to avoid bloat hazard.

E. Alfalfa - Causes bloat and produces less well on marginal soils, especially when grazed in shorter cycles than the re-growth period usually allowed for hay. It is also subject to winter "drowning out" when exposed to "wet feet" in soils possessing slow or impaired subsurface drainage. Usually disappears in a relatively short time.

III. RECOMMENDED SEED MIXES

A. Fattening Lambs - Five pounds per acre of Prostrate Birdsfoot Trefoil alone, or three pounds of Trefoil and 2-3 pounds of Salina Clover. No grass is recommended because lambs tend to fatten best on straight clover. Grass tends to make them grow, but not fatten.

B. Breeding Ewes - Perennial Ryegrass is recommended in addition to Narrowleaf Trefoil and Salina Clover. Three - four pounds per acre should be sufficient to establish it, but up to 6 pounds would produce a thicker initial stand. Ewes tend to get too fat on a solid clover pasture, so the Ryegrass helps to prevent this. If the pasture is to feed both fattening lambs and ewes, a solid clover seeding is again recommended, but the ewes should be run behind the lambs to clean up fields already grazed of much of the clover.

C. Beef and Dairy Cattle - Orchard Grass - 6 pounds per acre; Perennial Ryegrass - 4 pounds per acre; Prostrate Birdsfoot Trefoil - 3 pounds per acre; Salina Clover - 2 pounds per acre.

More total seed per acre will tend to produce thicker initial stands, but a 15 pound total per acre will usually catch up to higher seeding rates in a year or so. The seed should be drilled or broadcast onto a prepared seedbed. After broadcasting, the seed should be pressed into the soil shallowly by means of a roller device.

FERTILIZER

Maximum production of grass in irrigated pastures requires relatively frequent applications of nitrogen. An adequate rate would be approximately 50 pounds of actual nitrogen per acre each 4-6 week period during the warm weather growing season. In actual practice, this amount of nitrogen is seldom if ever applied, for economic reasons and because of possible "crowding out" effect to clover production by grasses. Since most pasture operators value the clover portion of the pasture highly, nitrogen usage is usually kept down or eliminated entirely. Clover, of course, requires no supplemental nitrogen because of its ability to produce its own supply. Clover does draw heavily on phosphorous reserves in soil and eventually requires this element in most marginal soils after a few years of production. As a general rule, 22-44 pounds of elemental phosphorous per acre (50-100 pounds of P_2O_5) annually will meet the clovers needs. No shortage of potash is yet known to exist in pasture soils in Solano County, so this element is not yet recommended for routine fertilization. The bicarbonate method of soil extraction is recommended for determining whether or not a soil requires phosphorous. Critical levels are those below 6 parts per million.

WATER REQUIREMENTS

Irrigated pasture requires rather frequent and rather shallow irrigations throughout the growing season. This results in close to four acre-feet of applied water per acre per season in many years. How often water must be applied is determined by such factors as the effective rooting depth, available moisture per foot of rooting depth, and the current daily rate of water removal from the soil. For example, a clay soil with pasture roots penetrating it to a depth of 2 feet may well supply two inches of moisture per foot of depth of soil after it has been irrigated. The moisture removal rate per day during the hottest, least humid time of year in the summer, can well approach 0.3 of an inch per day, off land completely covered by green growing plants. Obviously, the four inches of available moisture would be removed in 13 days. In practice, though, it is not advisable to wait until all the moisture is gone before irrigating again, as this puts undue stress on the pasture and reduces production markedly. It might be practical in this example to allow a removal of three-fourths of the water (3 inches) and irrigate again in 10 days. Since most flood irrigation systems approach an efficiency of 70%, about 4.3 acre-inches of applied water per acre would be required to replenish the 3 inches removed from the soil. Wider intervals than this would be allowable in the cooler months. Sometimes clay pan soils are found that have only $1\frac{1}{2}$ feet of sandy loam soil over the pan. This foot and a half of soil may well supply only $2\frac{1}{4}$ inches of available moisture. At the highest removal rate, this soil would run dry in $7\frac{1}{2}$ days and should be irrigated in six days before the moisture is more than three-fourths gone. An application rate of 2.5 inches every week might well be necessary in this example during the hottest months.

STOCKING RATE

An <u>average</u> of approximately 1,000 pounds of live animal weight per acre will adequately stock <u>unsupplemented</u> irrigated pasture throughout the season, from spring through early fall. However, this rate varies markedly with season of year, type of livestock, pasture age and management. Pastures tend to produce their best in the spring and early summer and then taper off gradually into the late summer and fall. The second and third years tend to be more productive than later years. Seven years is probably as long as pasture should be allowed to grow if the drop in productivity with age is to be kept at economically feasible levels. Properly managed irrigated pasture requires the grazing pressure be varied with the changing levels of production through the season. This is done by raising or lowering the number of animals (total live animal weight) per acre, or by providing supplemental feed when the pasture production falls or by mowing part of the pasture for hay or "green chop" when the pasture production is ahead of the available stocking rate. Most certainly, continuous overgrazing should be avoided. This not only hurts pasture production, but also may well increase the incidence of animal parasites, such as stomach worms.

WEED CONTROL

A practical approach to weed control in irrigated pasture involves the judicious use of a mowing machine, hand hoeing of weeds found only in spots and proper attention to drainage to prevent water loving plants (dock, sedge, watergrass, rushes, etc.) from increasing. Some use of chemical herbicides is practical, especially along fence lines and ditches. Herbicide use is limited however, because of the expense involved and problems associated with regulations governing the use of Agricultural Chemicals. The mowing machine is a must and will come in very handy right away. Fall seeded pasture often produces a bumper crop of native range plants in land newly placed under irrigation. Such plants as Bur Clover, Wild Oats, Filaree, Foxtails and Thistles will often make a new pasture look as if nothing else is there. An early spring mowing or grazing before these plants set seed will often do a world of good and will "open" the pasture for the newly seeded varieties to increase.

RECENT TRIAL RESULTS OF ANIMAL GAINS ON IRRIGATED PASTURE IN SOLANO COUNTY

Method of Securing Data

A bit more light has been shed on the question of how many pounds of animal gain per acre can be produced on a well managed irrigated pasture. This, and the question of what is the daily gain per head day, were answered in a series of three measurements made in 1966 in Solano County.

The most complete picture came off a 71 acre irrigated pasture in the Cordelia area. The owner cooperated with this office in supplying the figures of the total number of animals and their weights going on and off the pasture throughout the entire season. The figures included which scales were used (home ranch or public auction), dates of purchases and sales, number of head and actual weights of each group of animals handled, weighing conditions, etc. The data was transmitted to the Farm Advisor regularly through the season and was summarized at the end.

Description of Pasture

Three pastures were involved. One 19 acre field was planted in the Fall of 1962 to Prostrate Birdsfoot Trefoil, Salina Clover, Perennial Ryegrass, and Orchard Grass. One 11 acre field was planted the Fall of 1963 to Prostrate and Erect Birdsfoot Trefoil and Salina Clover. The remaining 41 acre field was planted the Fall of 1964 to Prostrate Birdsfoot Trefoil and Salina Clover. The 71 acre total includes a generous amount of land devoted to ditches, ditch pads,and lanes. All pastures were irrigated in strip checks.

Cattle Stocking Figures

The pasture was stocked March 18, 1966, with 155 head of overwintered stocker steers, approximately 1/2 of Hereford and Angus blood and the other half of beef X dairy crosses.

The following "IN" data was made through the season:

DATE	NUMBER OF HEAD		AVERAGE WEIGHT
March 18, 1966	155		573.4
May 11, 1966	21		418.6
June 6, 1966	60		464.7
August 3, 1966	23		433.3
TOTAL	259	Overall Mean	523.2

Sales off pasture were as follows: ("OUT" Data)

DATE	NUMBER OF HEAD		AVERAGE WEIGHT	REMARKS
April 20, 1966	19		774.5	
May 25, 1966	23		883.7	
June 1, 1966	26		751.9	
July 27, 1966	25		672.0	
September 7, 1966	2		437.5	Sick
September 22, 1966	40		693.1	
September 28, 1966	1		530.0	Sick
October 19, 1966	22		950.7	
November 12, 1966	96		673.2	Put on "hill" feed
TOTAL	254	Overall Mean	732.5	

Summary of Production Data

Length of 1966 Pasture Feeding Period - 240 days (March 18 - November 12)		
Total Cattle Head Days Supplied	34,645	
Total Cattle Gain	50,545	pounds
Average "Gain" per Head Day	1.46	pounds
Average Stocker Steer Stocking Rate/Acre	2.03	
Average "Out" Weight per Stocker Steer	732.5	pounds
Average "In" Weight per Stocker Steer	523.2	pounds
Average "Gain" per Stocker Steer	209.3	pounds
*Total Cattle Gain Per Acre	711.9	pounds
Total Number Feeder and Replacement Lambs Fed	91.0	
Average "Gain" per lamb	39.1	pounds
**Total Lamb Gain per Acre	50.1	pounds
Total Cattle and Lamb Gain per Acre	762.0	pounds

*These gain figures were based on actual scale weights taken at the public auction sales. Home ranch weights, made after a short drive from pasture were given a 3% pencil shrink. All gains are on an unsupplemented basis and represent "saleable" pounds produced. No credit was given the pasture for three steers that died on pasture, or for one 4-H steer and one steer eaten at home. A total of 259 calves were handled, so the death loss amounted to 1.15%

**Sheep gains reported are only those of the lambs. No credit is given for weight gains or wool from 33 ewes that pastured from March 20, 1966 to June 15,1966 with their 38 lambs.

CONCLUSIONS

This was a very excellent yield, the best yet recorded in the Farm Advisors Office for a Solano County pasture. To be sure, it reflected the extra long grazing season enjoyed in 1966, as well as the relatively young pasture age. However, such returns as these are evidence that irrigated pasture can produce a decent gross income potential if properly handled. It helps explain the reason for the shift to feeding cattle instead of sheep.

Cattle graze less selectively than sheep and make leaner gains. This probably results in more pounds of gain per acre than can be achieved from lambs alone.

ADDITIONAL GAIN PER HEAD DAY INFORMATION

A study involving 26 head of stocker steer calves, taken as a random sample from a group of 166 head was run on an old pasture west of Hastings Island. Each calf was individually eartagged and weighed on a portable scale at the beginning and end of the study period. The calves were mostly straight Hereford or Hereford-Angus Cross. A small amount of hay, cut in the spring from the pasture, was fed starting July 1. This was estimated at five 120 pound bales per day. The following data was secured:

Length of Study Period (May 27, 1966 - September 28, 1966)	124 days
Average "Out" Weight per Steer	865.6 pounds
Average "In" Weight Per Steer	677.1 pounds
Average "Gain" Weight per Steer	188.5 pounds
Average Gain per Head Day	1.52 pounds

No records were available on the acreage available to these calves, since there were other cattle coming and going on the pasture besides the 166 head, and all the cattle were rotated around the pasture. This prevented any estimate of total gains per acre.

A spot check of a 29 day grazing period was made on 81 head of predominately Hereford steers on a two year old 30 acre Salina Clover-Birdsfoot Trefoil pasture at Cordelia. The cattle were driven about one mile to the scales and weighed at 7:30 A.M. The following data was obtained:

Study Period (April 20, 1966 - May 19, 1966)	29 days
Number of Calves per acre	2.7
Average "Out" Weight per Steer	717.0 pounds
Average "In" Weight per Steer	669.6 pounds
Average "Gain" per Steer	47.4 pounds
Average "Gain" per Head Day	1.63 pounds
Total Gain per Acre per Day	4.4 pounds

Again, no estimate was possible of the total gain per acre within the limitation of this check. However, a pattern is emerging on head day gain. All three checks had a range of head day averages running from 1.46 pounds to 1.63 pounds. This is a relatively narrow range, considering differences in age of pasture, stocking rates and location.

SAMPLE COST OF PRODUCTION
(Revised 1967)

Costs of irrigated pasture vary with purchase prices of land, levelling requirements, water source, taxes, fertilization practices, etc., so no one sample cost can do more than illustrate a possible situation and suggest a means of figuring costs in other situations by changing the amounts as they are indicated. The following figures are based on per acre costs:

Interest on depreciable items is figured at 1/2 the original cost each year. As this represents the average value from full value at the start of depreciation to nothing at the end. 6% interest rate was arbitrarily selected - others may consider a different value more realistic.

OVERHEAD	COST	LIFE EXPECTANCY YEARS	DEPRECIATION	INTEREST AT 6% ON 1/2 COST	MY OWN COST
Land (Including Barns and Corrals)	$300.00			$18.00*	_____
Grading (Including Irrigation and Drainage Ditches)	125.00			7.50*	_____
Fences (Including Border and Cross)	21.00	20	$1.05	0.63	_____
Turnout Gates	2.50	10	0.25	0.08	_____
Stock Water Facilities	2.50	20	0.12	0.08	_____
Pasture Stand (Including Seed, Seeding and Irrigating Up)	20.00	7	2.86	0.60	_____
Tillage Equipment					
Tractor	9.85	10	0.99	0.30	_____
Mower	1.58	10	0.16	0.05	_____
Pickup Truck	7.88	10	0.79	0.24	_____
Miscellaneous (Shovels,etc.)	0.79	10	0.08	0.02	_____
TOTAL INITIAL INVESTMENT COSTS PER ACRE	$491.10	TOTAL ANNUAL DEPRECIATION PER ACRE	$6.30	TOTAL INTEREST $27.50	

*Interest at full cost because land and levelling costs are not considered depreciable items.

Total Overhead (Including Interest and Depreciation) $33.80

ANNUAL CULTURAL COSTS

CASH AND LABOR COSTS---			
Irrigate 16 times @ 1/2 hour @ $1.50	$12.00		_____
Water - 4 Acre feet @ $5.19 (estimated)	20.76		_____
Fertilizer - 22 pounds P (50 pounds P_2O_5)(est.)	5.00		_____
Mow 3 times @ 1/2 hour @ $3.00	4.50		_____
Ditch Work and Fence Repair	1.00		_____
Miscellaneous Labor and Truck Use	1.00		_____
Taxes (estimated) - $6.00/100 @ $150.00	9.00		_____
Total Cash and Labor	$53.26		_____
TOTAL COSTS, INCLUDING OVERHEAD AND CASH AND LABOR	$87.06	$87.06	_____