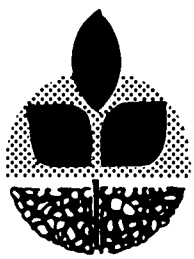
Irrigated Spring Wheat: A Production Guide for Central Oregon

Circular of Information 685
May 1980



Agricultural Experiment Station
Oregon State University, Corvallis

IRRIGATED SPRING WHEAT:

A PRODUCTION GUIDE FOR CENTRAL OREGON

S. R. James and M. J. Johnson*

INTRODUCTION

Recently released high yielding spring wheat cultivars have increased the profit potential over the older cultivars such as Federation and Idaed. Spring wheats now available will outyield early spring seeded winter wheat. As new cultivars are released, new cultural practices which result in optimum yields must be identified. This report discusses aspects of cultivars, fertilization requirements, seeding dates, seeding rates, weed control, and irrigation which lead to successful production of irrigated spring wheat in Central Oregon.

WINTER OR SPRING WHEAT---WHICH?

Until recently, spring wheat yielded less than early spring seeded winter wheat. High yielding spring wheat cultivars capable of yielding 90 to 100 bushels/acre under optimum conditions have been developed. Spring wheat cultivars should not be planted before March 1 to avoid possible yield reduction or stand loss from frost damage; winter wheat must not be planted too late to insure vernalization. Tables 1 and 2 summarize several experiments conducted in Central Oregon to determine when to plant spring wheat versus winter wheat. Winter wheat should not be planted later than the last week of February in the Madras area. Planting winter wheat after the first week of March is not recommended in Powell Butte, Cloverdale, Prineville, and similar areas.

---

*Agronomy Technician and Superintendent, respectively, Central Oregon Experiment Station, Oregon State University, Redmond, Oregon, 97756

Table 1. The effects of seeding dates on selected spring (S) and winter (W) wheat cultivar yields grown at Redmond

CULTIVAR	HABIT	SEEDING DATE 2/25/74	3/29/74	3/7/75	5/1/75
		bu/acre			
Twin	S	55.6	62.2	54.6	59.1
Springfield	S	44.8	59.3	49.4	68.5
Peak	S	37.2	47.2	51.4	50.8
Hyslop	W	60.9	38.1	63.5	0.0
Nugaines	W	54.3	42.5	62.4	0.0
McDermid	W	61.8	38.9	63.7	0.0
LSD 0.05				NS	10.9

Table 2. The effects of seeding dates on selected spring (S) and winter (W) wheat cultivar yields grown at Madras

CULTIVAR	HABIT	SEEDING DATE 3/30/78	4/21/78	3/14/79	4/5/79
		bu/acre			
Fieldwin	S	61.4	36.3	90.8	78.2
Fielder	S	70.5	41.1	89.7	69.4
Springfield	S	70.4	44.5	84.1	70.6
Twin	S	68.0	38.6	84.0	68.1
Daws	W	----	----	84.1	15.0
Stephens	W	20.5	0.0	78.4	11.4
Nugaines	W	20.5	0.0	77.1	27.1
McDermid	W	22.7	0.0	72.5	15.5
Hyslop	W	16.1	0.0	71.0	13.9
WS-1	S	68.8	44.3	----	----
LSD 0.05		8.6	8.2	14.8	14.0

SPRING WHEAT CULTIVARS

Yield potentials of spring wheats have increased significantly in the last decade. Cultivars such as Fielder, Fieldwin, Twin, and Springfield, when grown under optimum conditions, will outyield spring seeded winter wheat. Knowledge of individual cultivar traits and environmental factors that affect them is essential to obtain optimum yields. A list of the traits of the top yielding spring wheat cultivars follows.

FIELDER--Fielder is a semidwarf, soft white, stiff-strawed cultivar of medium maturity. Yields average 5 bushels/acre more in the Madras area and 5 bushels/acre less in the Redmond area than yields of Twin. Height averages 35 inches under ideal growing conditions in Idaho, but is generally 2 to 3 inches shorter in Central Oregon. The test weight of Fielder exceeds those of Twin and Springfield by about 3 pounds/bushel (12). Fielder is susceptible to stripe rust.

FIELDWIN--Fieldwin is similar to Fielder in appearance, but averages one inch taller and one day later in maturity. Under ideal conditions Fieldwin will outyield Fielder, both in the Madras and Redmond areas. The test weight is slightly higher than the test weight of Fielder. Fieldwin is susceptible to stripe rust (13). Limited testing indicates Fieldwin to be a promising cultivar in Central Oregon.

SPRINGFIELD--Springfield is a semidwarf, soft white cultivar with moderately stiff straw. Springfield is similar in yield to Twin. It is resistant to stem and stripe rust, but susceptible to leaf rust and powdery mildew. Test weight is about 3 pounds/bushel less than Fielder and similar to the test weight of Twin (14).

TWIN--Twin is a sister selection of Springfield and has similar characteristics. Height averages about 1 inch taller than Fielder in Central Oregon. Twin yields better than other spring cultivars in the colder areas of Central Oregon such as Cloverdale. Twin, like Springfield, is susceptible to leaf rust and powdery mildew (15).

Performance of spring wheat cultivars is highly influenced by the location in which they are planted. Table 3 shows the response of selected cultivars to several Central Oregon locations. Fielder yielded well in Madras, but poorly in cooler areas. Twin yielded better in cooler locations than other cultivars. Limited testing of Fieldwin indicated it may yield well in all areas of Central Oregon.

Table 3. Performance of spring wheat cultivars in Central Oregon

	Madras(1)		Powell Butte(2)		Cloverdale (3)	
CULTIVAR	Yield bu/acre	Test wt.	Yield bu/acre	Test wt.	Yield bu/acre	Test wt.
Fielder	93	56.2	62	57.7	37	55.2
Fieldwin	95	56.4	69	58.3	--	----
Springfield	80	54.6	67	55.7	48	53.3
Twin	88	54.5	74	55.6	52	51.9
WS-1	83	53.3	54	51.1	42	50.6
Profit	85	57.5	--	----	48	56.2

(1) -- 4 years of data; (2) -- 3 years of data; (3) -- 1 year of data

FERTILIZER REQUIREMENTS

Good management practices are essential if optimum fertilizer responses are to be realized. Practices such as timely irrigation, use of suitable cultivars, weed control, correct seeding dates, and seeding rates will insure proper fertilizer utilization, thus leading to higher yields (5).

A soil test prior to any fertilizer application is the best way to determine fertilizer requirements. Consult a county Extension agent, agricultural consultant or fieldman and follow closely the recommended soil sampling techniques. A soil sample analyzed for pH, phosphorus, potassium and nitrate-nitrogen generally will be adequate for spring wheat production. Time, effort, and cost expended in a soil test can be repaid many times over by increased yields and elimination of unnecessary fertilizer.

Nitrogen left in the soil from a previous crop can greatly affect

grain yield. In a study conducted at Madras and Powell Butte, poor yields resulted when 80 pounds/acre of nitrogen was applied. The following year, high yields were obtained with the same nitrogen application rate. The difference in yields was primarily caused by different soil nitrate-nitrogen levels. With a soil nitrate-nitrogen level of 30 pounds/acre, 160 pounds/acre of applied nitrogen resulted in optimum yields in 1976. In 1977, 80 pounds/acre of applied nitrogen resulted in optimum yields because of the high soil nitrate-nitrogen level of 68 pounds/acre. Evidence thus indicates spring wheat requires 150 to 200 pounds/acre of total available nitrogen (soil nitrate-nitrogen plus applied nitrogen) to produce maximum yields when seeded March 10.

Proper nitrogen fertilization is essential to insure optimum yields, grain quality, and minimum lodging. Figure 1 shows the effects of nitrogen fertilization rates, seeding dates, and cultivars on grain yields. After March 10, the need for nitrogen decreased as seeding was delayed; 80 pounds/acre of nitrogen was sufficient for later seeding dates. Nitrogen rates above optimum levels increased vegetative growth at the expense of grain yield and produced taller plants with broader leaves and smaller kernels (6). Excessive nitrogen also increased lodging.

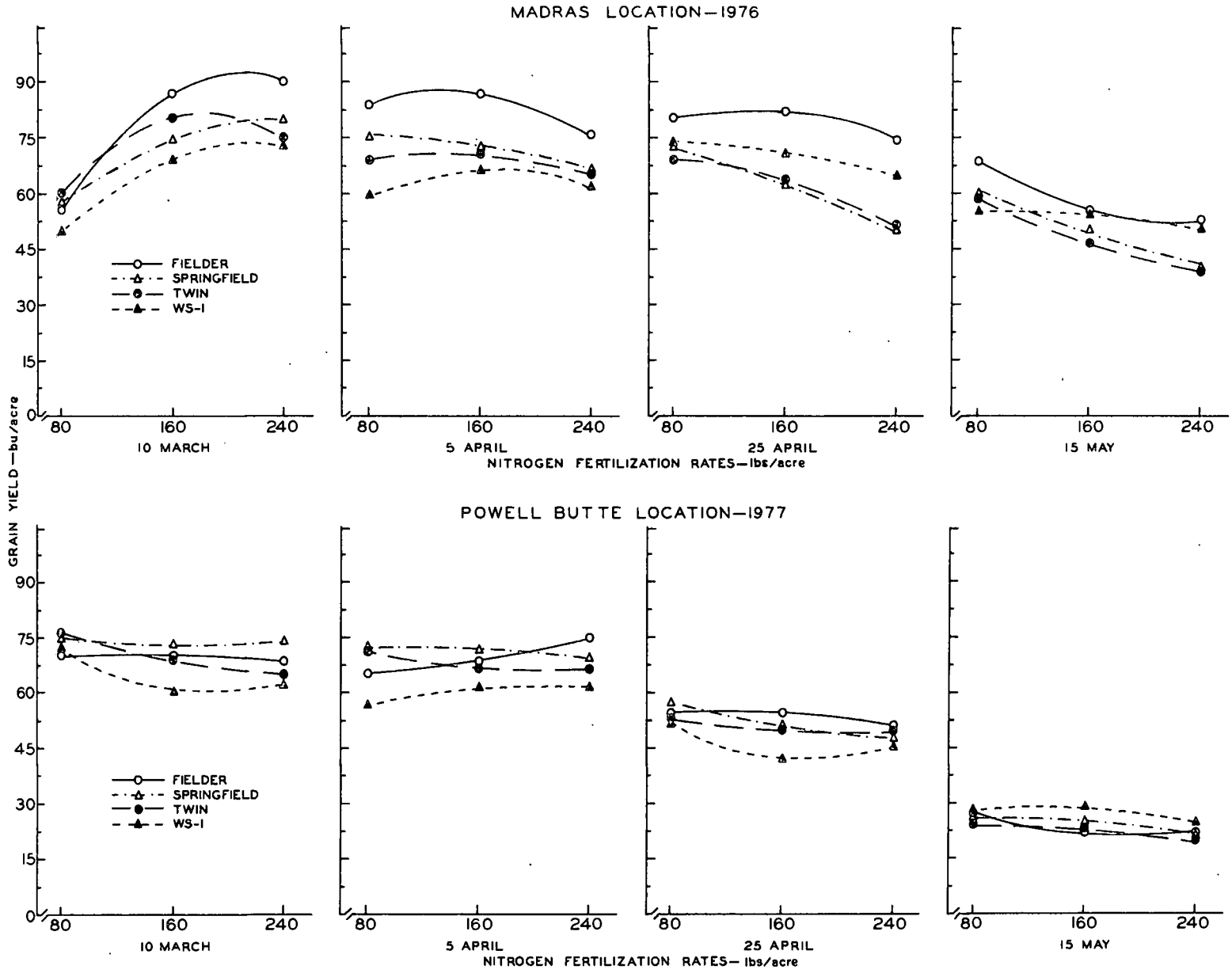
Adequate phosphorus, potassium, and sulfur levels must be maintained to insure optimum yields. Actual requirements should be determined from soil test values. Generally, 40-100 pounds/acre of phosphorus will be required. Central Oregon soils normally have moderate to high levels of potassium unless they have been intensively cropped for many years. Sulfur leaches rapidly from light soils and 60 to 80 pounds/acre is needed each year. Avoid using elemental sulfur as it lowers the soil pH excessively (5).

SEEDING METHODS

SEEDING DEPTH

Spring wheat generally is sown 1 to 2 inches deep (7). In areas of Central Oregon with lighter soils, seed should be planted 1.5 to 2 inches deep. Early seeding dates require seeding depths of 2 inches to insure seedling survival. It is desirable to use certified seed which has been treated to control loose smut (Ustilago tritici) and common bunt

Fig. 1. The effect of seeding dates, nitrogen rates, and cultivars on the yield of irrigated spring wheat



(Tilletia foetida and T. caries).

SEEDING DATE

Seeding date has a profound influence on the yield of irrigated spring wheat. Yields steadily decrease as seeding is delayed (2,8,10). Table 4 indicates the effect of seeding dates on three cultivars in Madras and Powell Butte. For each week seeding is delayed past March 10, grain yields decrease approximately 2 bushels/acre. Optimum yields are obtained by seeding early March to early April; seeding after May 1 should be avoided.

Table 4. The effects of seeding dates on yield of selected spring wheat cultivars grown under optimum conditions

Location	Cultivar	Seeding date			
		March 10	April 5	April 25	May 15
		yield-bu/acre			
Madras	Fielder	87.0	84.2	80.0	68.7
	Twin	74.7	75.0	73.1	59.6
	Springfield	79.6	67.9	68.6	57.5
	AVG.	80.4	75.7	73.9	61.9
Powell Butte	Fielder	70.4	65.1	55.6	27.5
	Twin	74.5	72.6	56.7	26.8
	Springfield	75.9	71.9	53.5	23.5
	AVG.	73.6	69.9	55.3	25.9

SEEDING RATE

Seeding rates for irrigated spring wheat depend largely on the seeding date. Studies have shown that yields increase at later seeding dates when higher seeding rates are used (4,10). Table 5 summarizes the effects of seeding rates of 90, 135, 180 pounds/acre at four seeding dates. There was no advantage in seeding above 90 pounds/acre when planting before mid-April. At late seeding dates, higher yields resulted from seeding rates greater than 90 pounds/acre, but seeding after May 1 is not recommended.

In emergency situations when late seeding is necessary, higher seeding rates may be required to increase grain yields. A reduction in

tiller number occurs when spring wheat is seeded late; higher seeding rates compensate by producing more heads. Also, kernel weight increases with higher seeding rates at late dates, thus yields are increased.

Table 5. The effects of seeding rates and dates on irrigated spring wheat yields (1976 and 1977)

Seeding Rate	Seeding Date			
	March 10	April 5	April 25	May 15
--lbs/acre--	----------yield-bu/acre----------			
90	69.6	69.2	57.8	36.6
135	71.4	68.9	60.0	38.7
180	69.1	69.1	60.3	41.1

WEED CONTROL

CHEMICALS

With normal crop rotation in Central Oregon, weed control measures in spring wheat generally are needed. Problem weeds most commonly encountered are lambsquarters, pigweed, and annual mustards. The 1979 Oregon Weed Control Handbook lists chemicals available for control of common weeds. These include 2,4-D, MCPA, bromoxynil, and dicamba.

2,4-D--Lambsquarters, pigweed, and most annual mustards will be selectively controlled by 2,4-D in spring wheat. It is available in water soluble amine form and in ester form, which is emulsifiable in water. Amine salts of 2,4-D are very soluble in water and are nonvolatile. The esters of 2,4-D are more volatile than amine salts, especially at high temperatures, thus creating a potential hazard to domestic plants. The advantage of esters over amine salts is their ready penetration into plant tissue.

MCPA--MCPA is very similar to 2,4-D, but has a longer residual toxicity than 2,4-D. MCPA is less injurious to wheat than is 2,4-D and is generally the herbicide of choice for mixing with bromoxynil. MCPA will control filaree (stork's bill), which 2,4-D does not control. Both 2,4-D and MCPA are plant growth regulators with a systemic effect on plants.

BROMOXYNIL--Many weeds somewhat resistant to 2,4-D are controlled by bromoxynil (except for annual grasses and perennial weeds). There is

less drift hazard with bromoxynil and it is less toxic to humans than either 2,4-D or MCPA. It is commonly mixed with other herbicides such as MCPA.

DICAMBA--Dicamba is useful in controlling weeds, such as knotweed, which are resistant to 2,4-D and MCPA. Where there is a mixture of mustards, lambsquarters, pigweed, filaree, and knotweed, a 3-way mixture of MCPA, bromoxynil, and dicamba is of considerable benefit. Spring wheat sprayed with dicamba may show some leaf and stem distortion for a period after treatment (9).

HERBICIDE APPLICATION

Herbicides must be applied correctly to get optimum benefit. Damage to the wheat crop must be minimized to insure high grain yields. Wheat yields are markedly reduced by 2,4-D and MCPA when applied at two critical periods: when plants are from 1 to 6 inches tall, and from early boot stage to flowering (7). MCPA and 2,4-D should be applied when plants are from 6 to 8 inches in height. Bromoxynil should be applied as soon as most weeds have germinated. Only small weeds will be controlled effectively (1).

IRRIGATION

Soil moisture stress at any stage of growth can decrease grain yields of irrigated spring wheat. It is especially important that soil moisture be adequate during jointing, flowering, and early soft dough stages. Studies have shown that yields may be reduced 30 to 50 percent by improper irrigation during these growth stages (7,3). Perhaps the most critical period is the jointing stage; moisture stress then produces fewer and smaller heads. Improper irrigation during flowering and early soft dough stages result in yield depressions because of light and shriveled seeds (3).

Regular irrigation schedules coupled with consideration for hot and drying conditions will help insure good crop yields.

LODGING

Uncontrollable factors such as wind, rain, and hail often cause

severe lodging in irrigated spring wheat. However, lodging can be reduced by proper management.

Lodging is more prevalent when higher nitrogen rates are used. Table 6 shows the results of a study conducted in Madras in 1976. Average lodging increased 8 percent for every 80 pounds/acre of nitrogen applied above 80 pounds/acre. Cultivars also differed in their individual susceptability to lodging. Fielder was most resistant to lodging; Twin was less tolerant. Therefore, selecting lodging-resistant cultivars and avoiding excess nitrogen help reduce lodging losses.

Table 6. The effect of nitrogen fertilizer on percent lodging of selected spring wheat cultivars

CULTIVAR	Nitrogen-lbs/acre 80	160	240	Avg.
	----------% lodging----------			
Fielder	5	14	18	12
Springfield	8	15	25	16
WS-1	6	16	25	16
Twin	13	21	29	21
AVG.	8	16	24	16

SUMMARY

1. Winter wheat should not be planted after March 1 in the Madras area or after the first week of March in the Redmond and Powell Butte areas.
2. Fielder is well adapted to Madras, but Twin performs better than other available cultivars in Powell Butte, Cloverdale, and other similar locations. Fieldwin, a newly released cultivar, may be adapted to all areas of Central Oregon.
3. Spring wheat requires 150 to 200 pounds/acre of total nitrogen when seeded early. Later seedings require less nitrogen.
4. Spring wheat will produce optimum yields when seeded before early April. Seeding after May 1 should be avoided.

5. Seeding rates above 90 pounds/acre are not advantageous except in emergency situations when late seeding is necessary.
6. Weed control measures generally are needed; spray 2,4-D and MCPA after plants reach 6 inches in height but before they enter the boot stage. Bromoxynil should be sprayed as soon as most weeds emerge.
7. Proper irrigation is critical to obtain optimum yields. Avoiding moisture stress during jointing, flowering, and early soft dough stages insures good crop yields.
8. Controllable factors which reduce lodging are cultivar selection and avoiding excess use of nitrogen fertilizers.

LITERATURE CITED

1. Appleby, A., D. Rydrych, and B. Brewster, 1979. Spring Cereals. In H. M. Hepworth (ed.) Oregon Weed Control Handbook. Extension Service, Oregon State University, Corvallis.

2. Black, A. L., and F. H. Siddoway, 1977. Hard red and durum spring wheat responses to seeding dates and NP-fertilizer on fallow. Agronomy Journal 69: 885-888.

3. Day, A. D., and S. Intalap, 1970. Some effects of soil moisture stress on the growth of wheat. Agronomy Journal 62: 27-29.

4. Dougherty, C. T., W. R. Scott, and R. H. M. Langer, 1975. Effects of sowing rate, irrigation, and nitrogen on the components of yield of spring-sown semi-dwarf and standard New Zealand wheat. New Zealand Journal of Agricultural Research 18-197-207.

5. Gardner, E. H., et.al., 1977. Fertilizer guide for irrigated semi-dwarf wheat. Oregon State University Fertilizer Guide. No. 40. Oregon State University, Corvallis, Oregon.

6. Gardner, R. R. and E. B. Jackson, 1976. Fertilization, nutrient composition, and yield relationships in irrigated spring wheat. Agronomy Journal 68: 75-78.

7. Leonard, W. H. and J. H. Martin, 1963. Cereal crops. MacMillan Co., New York. Pages 341-344.

8. McMurdo, George A., 1916. Cereal experiments by the Akron Field Station, Akron, Colo. USDA Bulletin No. 402.

9. Montgomery, M. L., V. H. Freed, and J. M. Witt, 1979. Chemicals and properties. In H. M. Hepworth (ed.) Oregon Weed Control Handbook. Extension service, Oregon State University, Corvallis.

10. Post, A. H., 1966. The effect of rate and date of seeding on yield of spring and winter wheat. Montana Agricultural Experiment Station Bulletin No. 609, Page 14.

11. Stickler, F. C. and A. W. Pauli, 1964. Yield and winter survival of winter barley varieties as affected by date and rate of planting. Crop Science, Volume 4, No. 5.

12. Sunderman, D. W. and B. Brunsma, 1975. Registration of four wheat cultivars. Crop Science, Volume 15, No. 1.

13. Sunderman, D. W., et al., 1978. Registration of Fieldwin wheat. Crop Science, Volume 18, No. 5.

14. Sunderman, D. W. and M. Wise, 1972. Registration of Springfield wheat. Crop Science, Volume 12, No. 2.

15. Sunderman, D. W. and M. Wise, 1972. Registration of Twin wheat. Crop Science, Volume 12, No. 2.