What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS

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Rotational Crop Guidelines for "New" Corn Herbicides

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Historically, the problem of herbicide carryover in NY State has most often been associated with the triazine herbicides, atrazine and Princep (simazine). As a result, Bladex (cyanazine), a short residual triazine, has been substituted for these herbicides in tank mix combinations the year before rotating to triazine-sensitive crops. Now that all Bladex registrations have been cancelled (effective December 31, 1999), this option is rapidly disappearing. Although inventories of Bladex may continue to be used at a maximum rate of 1qt/A of Bladex 4L or 1.1 lb/A of Bladex 90DF through the 2002 growing season, there is little Bladex available in market channels. Under the circumstances, it seems appropriate that corn growers become familiar with the rotational crop guidelines of the "new" corn herbicides and to review rotational options with products that contain atrazine.

"New" Corn Herbicides

Since many of the new corn herbicides are used at very low rates, there is an assumption that carryover will not be a problem. However, close attention to the labels reveals that some of these products have conservative rotational guidelines (Table 1). Of greatest concern to most field crop producers are the guidelines for planting alfalfa and other small-seeded legumes. Assuming that most applications with these products would be made in May or June, it would appear that alfalfa could be seeded safely in April of the following year with all of these herbicides except Basis Gold, Exceed, and possibly Scorpion III. The rotational crop guidelines shown in Table 1 indicate an interval 10.5 months for Scorpion III and an interval of 18 months for Basis Gold and Exceed. Rotational guidelines for perennial forage grasses are seldom specified on labels. As a result they are assigned the same interval in Table 1 as the "other crops" category. Two notable exceptions are for Permit and Exceed that have rotational intervals of 2 and 10 months respectively for forage grasses.

Table 1. Rotational crop intervals (months) for "new" corn herbicides

Herbicides	Alfalfa	Sweet Corn	Soybean	Dry Beans	Wheat	Oats	Forage Grasses	Other
Accent	10	10	0.5	10	4	8	18*	18
Basis	10	10	0.5	8	4	8	18*	18
Basis Gold	18*	10	10	18*	10	18	18*	18
Beacon	8	8	8	8	3	8	18*	18
Broadstrike**	4	18	0	4	4.5	4.5	26*	26
Exceed	18	3	18	18	3	3	10	18
Permit	9	3	9	9	2	2	2	-
Scorpion III	10.5	10.5	10.5	10.5	4	4	26*	16

* These crops fall into the "other crop" category on labels.
** Broadstrike + Dual and Python.

Atrazine Premixes

Labels for most atrazine premixes allow soybeans to be planted the year after application if application is made before June 10. These labels also caution that other crops, including vegetables (dry beans), spring-seeded small grains, and small-seeded legumes should not be planted the year following application. Experience has shown that carryover of atrazine under normal conditions is unlikely in NY State if the application rate is limited to 1 lb active ingredient per acre (lb ai/A) or less. Table 26 on page 54 of the 2000 Cornell Guide for Integrated Field Crop Management shows the lb ai/A of atrazine with labeled rates of altrazine premixes. This information can be useful when planning crop rotations.

Herbicide carryover is more likely to occur following a dry growing season like 1999 than when rainfall is normal or above normal. In addition, carryover problems are more likely to occur with reduced /no-tillage systems than when primary tillage is done with a moldboard plow.

Nutrient Management

Phosphorus and Agriculture III: Factors Affecting the Potential for Phosphorus Loss from Land to Water

Peter Kleinman, USDA-ARS; University Park, PA; Andrew Sharpley, USDA-ARS, University Park, PA; Ray Bryant, Dept. of Crop & Soil Sciences, Cornell; and Shaw Reid, Dept. of Crop & Soil Sciences, Cornell.

The transport of phosphorus (P) from agricultural lands to surface waters is a major cause of accelerated eutrophication. This article is the third in a series exploring environmental aspects of agricultural P. Previous articles in this series reviewed the underpinnings of environmental concerns over agricultural P and the principles of soil P chemistry.

Processes of P Loss

The loss of P in agricultural runoff occurs in sediment-bound and dissolved forms (Figure 1). Sediment P is associated with eroded soil particles and organic material and accounts for 90% of the P transported from cropland. It must be converted to the soluble form for use by algae, therefore, it is a slowly available long-term source of P for algae in water bodies. Thus, erosion control is the primary means of minimizing sediment P loss.

The dissolved P comes from the release of P from soil and plant material (Figure. 1). This release occurs when rainfall or irrigation water interacts with a thin layer of surface soil (1 to 2 inches) and plant material before leaving the field as surface runoff. Phosphorus often accumulates to higher levels in this surface soil layer than deeper within the soil. Most dissolved P is immediately available for biological (algae or higher plant) uptake. Surface runoff from grass, forest, or non-cultivated soils carries little sediment, and is, therefore, generally dominated by dissolved P.

In most cases, P loss from agricultural lands occurs mainly in surface runoff rather than subsurface flow. However, in some soils, notably well drained glacial till and sandy soils, or well-structured soils with subsurface drains, P can be transported in drainage waters.

Land Management and P Loss

The sources of P loss in surface runoff are native (pedogenic) P in soil and/or P applied as fertilizer or manure. The loss of native soil P is small, usually less than 0.1 lbs/acre/year. Of greater concern is the loss of P in runoff after the application of fertilizer P and manure or where the soil has high P from previous fertilizer or manure applications. These losses are influenced by rate, time, and method of application; form of fertilizer or manure, amount and time of rainfall after application; and land cover. As might be expected, P loss in runoff increases with greater amounts of P added. However, incorporation of applied P into the soil profile either by tillage or subsurface placement, reduces the potential for P loss in runoff.

The loss of P is often small from the standpoint of the farmer (generally < 2 lbs/acre/year) and represents a minor proportion of fertilizer or manure P applied (generally < 5%), unless rainfall immediately follows application or where runoff has occurred on steeply sloping, poorly drained and/or frozen soils. Generally, these losses are not of immediate economic importance to farmers. However, they may nonetheless be costly to society by contributing to eutrophication of downstream aquatic ecosystems.

We know that P added to soil as fertilizer or manure can be sorbed by soil colloids and electrolytes. However, soil is not an infinite sink into which P can be poured, without the potential for losses occurring. Increases in soil test P can increase the loss of P in agricultural runoff. While data are currently limited to only a few soil types and situations, these data provide the scientific basis for establishing critical soil P levels above which soil P may enrich surface runoff with P to unacceptable levels. In other words, if maximum allowable P concentrations in agricultural runoff are proposed, we may be able to estimate at what soil P level this concentration will probably be exceeded. More data of this type are needed for different soil types, crop cover, surface runoff volumes, and erosion potentials, so that recommendations for fertilizer and manure use can be developed that will be effective for crop production and farm management, yet flexible enough to be workable and economical for farmers. This research need is the subject of the National P Project, a collaborative research effort among, ARS, Cornell and other land grant universities, NRCS, and EPA, and will be the subject of the next issue of *What's Cropping Up?*

Critical Sources of P Loss

Surface runoff generally occurs only from limited source areas within a watershed. These source areas vary rapidly in time, expanding and contracting quickly during a storm as a function of rainfall intensity and duration, antecedent moisture conditions, temperature, soils, topography, ground water, and moisture status over a watershed. As surface runoff is the main mechanism by which P and sediment is exported from most watersheds, it is clear that if surface runoff does not occur P export will be negligible. Thus, consideration of how water moves and where surface runoff occurs is critical to a more detailed understanding of P export from agricultural watersheds.

Also, the amount of P loss necessary to cause water quality problems usually is very small compared to the amounts required by crops or contained in typical manure or fertilizer P applications. Consequently, this complicates strategies to change farm management, because the loss is too small to show up in most standard practical or economic indicators of crop production efficiency used for farmers.

Minimizing P loss from agricultural lands involves consideration of several factors. To cause an environmental problem, there must be a source of P (i.e., a high soil concentration, manure or fertilizer P applications, etc.) and it must be transported to a sensitive location (i.e. through processes such as surface runoff, erosion, and leaching). Problems occur where these two factors come together. A source containing a high level of P with little opportunity for transport, may not constitute an environmental threat.

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Likewise, a situation where high potential for transport exists, but where there is no source of P, is also not a threat. The concern and emphasis of management practices should be focused on areas where these two conditions coincide. These areas are called critical source areas.

For instance, an ARS study in central Pennsylvania determined that roughly 90 percent of P exported from an agricultural watershed derived from just 10 percent of the land (Pionke et al., 1997). Even in regions where subsurface flow pathways dominate, areas contributing P to drainage waters appear to be restricted to soils with high soil P saturation and hydrologic connectivity to the drainage network. For example, Schoumans and Breeuwsma (1997) found that soils with high P saturation contributed only 40% of total P load, while a further 40% came from areas where the soils have only moderate P saturation but some degree of hydrological connectivity with the drainage network.

As a result, preventing P loss is now taking on the added dimension of defining, targeting, and remediating critical source areas of P that combine high soil P levels with high surface runoff and erosion potentials. This approach addresses P management at multi-field or watershed scales. Further, a comprehensive P management strategy must address down-gradient water quality impacts such as the proximity of P-sensitive waters. Conventionally applied remediations may not produce the desired results and may prove to be an inefficient and costly approach to the problem, if this critical source area perspective to target P applications, surface runoff and erosion control technology is not used.

References

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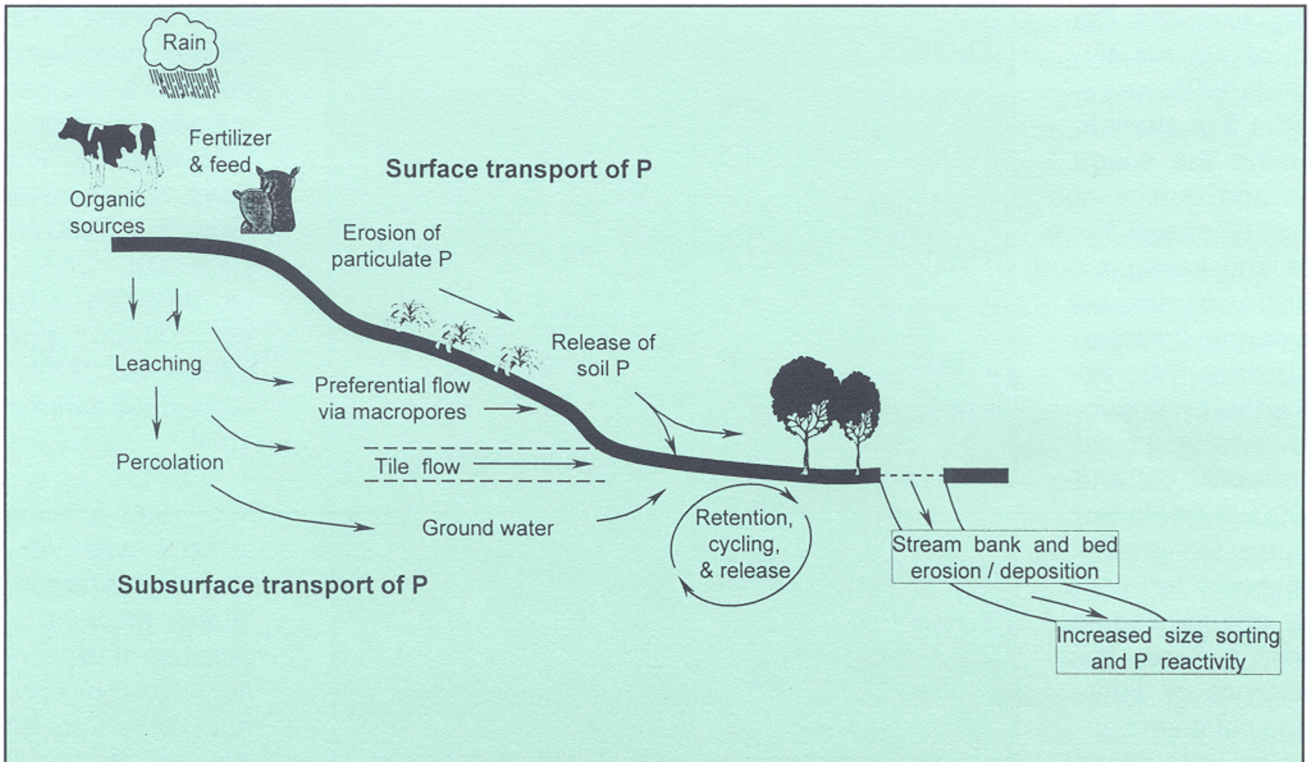

Figure 1. Factors affecting the transport of P to surface waters in agricultural ecosystems.

Crop Management

Corn Silage Hybrid Performance in New York

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Seed companies recently developed hybrids specifically for silage use. For example, Cargill released the brown midrib and Mycogen released the TMF (Total Managed Feeds) hybrids, both of which have been bred for stover quality characteristics. Interestingly, both seed companies recommended that their hybrids have harvest populations of 26,000 plants/acre, significantly less than the recommended 30,000 to 34,000 plants/acre by Cornell. Understandably, the cost of these hybrids as well as transgenic hybrids, such as Bt or herbicide resistant hybrids, exceeds the cost of normal hybrids. In 1998, we initiated a 3-yr study to examine the silage yield and quality of specialty silage hybrids and transgenic hybrids compared with normal commercial hybrids. We examined the hybrids under two harvest plant densities (27,000 and 34,000 plants/acre) because the greater seed costs for specialty and transgenic hybrids increase the importance of determining optimum densities for corn silage producers.

The 1998 growing season was favorable for corn silage production except for a dry August, which resulted in premature leaf senescence and relatively low whole plant moisture (57 to 60%) at the 1/2 milk line stage of development. Silage yields averaged 25.1 tons/acre at harvest populations of 34,000 plants/acre and 23.8 tons/acre at 27,000 plants/acre (Table 1). Interestingly, the TMF hybrids, except for TMF 108, and the brown midrib hybrids (F867 and F657) showed 1 to 2 ton/acre yield responses at the higher plant densities in 1998. As expected, the longer-season hybrids (105-112 day hybrids), except for the brown midrib hybrids, yielded the greatest. The brown midrib hybrids, which were 110 to 112 days in relative maturity, yielded the same as the 97 to 99-day hybrids or about 15% less than hybrids with comparable maturity. The Bt vs. non-Bt counterparts (DK493 vs. DK493Bt, DK580 vs. DK580Bt, 3563 vs. 35N05, and 37M81 vs. 37R71) yielded the same in 1998.

Table 1: Corn silage yields of 19 hybrids at two plant densities in central New York in 1998

Hybrid	27,000 Plants/acre	34,000 Plants/acre	Mean
33V08	25.7	27.7	26.7
35N05	24.8	28.4	26.1
3563	25.8	26.7	26.1
3523	26.5	25.7	26.1
DK580	24.0	27.3	25.7
TMF106	23.5	26.9	25.2
TMF108	25.3	25.1	25.2
DK580Bt	25.0	24.8	24.9
34G81	24.6	24.8	24.7
WR2108L	23.5	25.7	24.6
TMF99	23.7	24.4	24.1
T286602	22.4	24.7	23.5
37M81	23.0	23.6	23.3
37R71	23.1	23.1	23.1
DK493	22.2	23.8	23.0
DK493RR	22.7	23.3	23.0
DK493Bt	23.2	22.7	22.5
XB867	21.3	23.7	22.5
F657	21.3	22.1	21.7
	23.8	25.1	
LSD 0.05	0.5		2.0

The 1999 growing season was very unfavorable for corn silage production because of very dry and warm conditions from May through July. Despite the dry conditions, silage

Table 2. Silage yield of 30 hybrids in central New York in 1999.			
Hybrid	27000 Plants/acre	34000 Plants/acre	Mean
33V08	11.8	11.9	11.9
34B82	11.4	11.6	11.5
3523	11.2	11.4	11.3
TMF108	11.8	10.7	11.3
2720	11.6	10.9	11.3
N58-DI	12.4	10.2	11.3
34G82	11.3	11.2	11.3
TMF100	11.8	10.6	11.2
Asgrow 601	11.7	10.7	11.2
NK4687(Bt)	11.4	11.0	11.2
34G81	11.1	10.9	11.0
DK580(Bt)	10.8	11.2	11.0
TMF106	11.4	10.6	11.0
3563	11.6	10.3	11.0
35N05	11.0	10.8	10.9
DK580RR	10.7	10.5	10.6
DK580	10.5	10.4	10.5
TMF99	10.5	10.3	10.4
Asgrow 502	10.6	10.2	10.4
F657	9.8	9.8	9.8
F867	9.5	10.0	9.8
Asgrow 505Bt	10.1	9.2	9.7
37R71	10.1	9.9	9.7
DK493RR	9.4	9.4	9.4
DK493Bt	9.3	9.5	9.4
DK493	9.0	9.4	9.2
D493GR	9.2	9.2	9.2
37M81	8.6	9.3	8.9
XB667	8.6	9.1	8.8
397	8.3	7.9	8.1
	10.5	10.3	
LSD 0.05	NS		1.5

yields averaged the same at harvest populations of 34,000 plants/acre (10.3 tons/acre) and 27,000 plants/acre (10.5 tons/acre, Table 2). Nevertheless, the TMF hybrids, except for TMF99, yielded about 1 ton/acre less at 34,000 vs. 27,000 plants/acre at harvest. Apparently, the TMF hybrids are more sensitive to stressful conditions, especially at high populations, as indicated by very low grain content in the silage at harvest time (Table 3). In contrast, the brown midrib hybrids (F657, F867, XB667, and 397) generally yielded the same at 34,000 and 27,000 plants/acre. Likewise, most of the Pioneer and Dekalb hybrids yielded the same at 34,000 and 27,000 plants/acre. Surprisingly, the TMF hybrids, which had very low grain content in the silage, generally yielded the same as the hybrids with greater grain content. As in 1998, the brown midrib hybrids yielded less (~20%) than other hybrids in the same maturity group. Also, the Bt and non-Bt counterparts yielded the same in 1999.

The brown midrib hybrids had the greatest in vitro true digestibility (IVTD) among hybrids in both years of the study (Tables 4 and 5), despite relatively low grain content in the silage. Apparently, the very high fiber digestibility (NDF digestibility) of the brown midrib hybrids (Tables 4 and 5) offset their low grain content. Likewise, the TMF hybrids, which had grain contents of only 11 to 23% in 1999, had similar IVTD concentrations as hybrids with 45% grain in 1999, presumably because of their high fiber digestibility. As with silage yield, the Bt and non-Bt

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Table 3. Percent grain in the silage at harvest of 30 hybrids at two plant densities in central New York in 1999.

Hybrid	27000 Plants/acre	34000 Plants/acre	Mean
37M81	47	48	48
397	47	43	45
37R71	45	45	45
Asgrow 502	47	43	45
DK493	42	42	42
DK493RR	40	40	40
DK580	40	40	40
Asgrow 601	41	38	40
DK493Bt	40	39	40
34G82	38	40	39
DK493GR	40	37	38
DK580Bt	38	38	38
DK580RR	36	38	37
N58-D1(Bt)	41	33	37
34G81	36	34	35
3523	32	33	33
35N05	34	31	33
33V08	33	32	33
34B82	34	28	31
F657	34	28	31
TMF108	33	26	30
Asgrow 505Bt	31	26	29
3563	31	26	29
XB667	26	26	26
TMF100	32	13	23
F867	19	23	21
TMF99	16	18	17
NK4687(Bt)	18	11	17
2720	14	9	12
TMF106	15	6	11
LSD 0.05			5

counterparts generally had the same IVTD and NDF digestibility.

In conclusion, the brown midrib hybrids averaged about 5 to 10 percentage units more in IVTD and about 10 to 20 percentage units more

Table 4. In vitro true digestibility (IVTD) and neutral detergent fiber (NDF) digestibility of 19 hybrids, averaged across two plant densities, in central New York in 1998.

Hybrid	IVTD (%)	NDF Digestibility
XB867	84.3	54.2
F657	82.0	59.1
DK493Bt	79.9	49.9
35N05	79.7	49.6
DK493RR	79.5	47.3
DK580Bt	79.0	49.6
DK493	78.2	44.1
TMF99	77.1	49.0
33V08	77.0	43.6
TMF106	77.0	48.3
DK580	76.6	43.4
TMF108	76.6	45.9
37R71	76.0	39.0
WR2108L	75.9	41.1
37M81	75.6	39.8
3523	75.6	40.1
34G81	75.1	39.0
T286602	74.6	44.8
3563	74.2	38.0
LSD 0.05	2.0	4.4

Table 5. In vitro true digestibility (IVTD) and NDF digestibility of 30 hybrids averaged across two plant densities in central New York in 1999.

Hybrid	IVTD (%)	NDF Digestibility (%)
F657	91.4	78.6
F867	89.6	77.2
XB667	89.4	75.0
397	87.7	69.3
DK580RR	85.6	63.6
DK580Bt	85.3	62.7
Asgrow 502	85.2	61.0
TMF99	85.0	69.3
37M81	84.9	58.3
TMF108	84.8	65.7
TMF100	84.8	67.1
DK493RR	84.7	62.0
NK4687 (Bt)	84.6	69.3
3523	84.6	64.4
33V08	84.6	65.1
NK58-D1(Bt)	84.5	62.6
35N05	84.5	65.1
TMF106	84.3	68.6
3563	84.3	66.2
DK580	84.1	59.0
DK493GR	84.1	60.6
37R71	84.1	57.4
Asgrow 505Bt	84.0	62.3
DK493	83.9	59.5
34G82	83.9	58.8
Asgrow601	83.9	57.4
34G81	83.8	59.9
DK493Bt	83.4	58.4
34B23	83.3	61.4
2720	81.7	64.7
LSD 0.05	1.9	5.0

in NDF digestibility compared with other hybrids in this study. The brown midrib hybrids, however, yielded about 15 to 20% less than hybrids with comparable relative maturity. The TMF hybrids, despite having low grain concentrations especially in the dry year, had about the same silage yield and IVTD as other hybrids in this study. Apparently, the relatively high NDF digestibility of the TMF hybrids resulted in similar IVTD as hybrids with high grain concentrations. The Bt vs. non-Bt counterparts yielded the same and had similar silage quality in this study where corn borer pressure was relatively low.

Ken Wise Joins CCE Livestock / Field Crops IPM Team

Ken Wise joined the CCE Livestock / Field Crops IPM Team November 1, 1999.

Ken assumes responsibilities as the Eastern New York Area IPM Educator for livestock and field crops. Ken will assist Extension staff in providing leadership for developing and communicating IPM knowledge and information to field crops and livestock clientele. His primary responsibility will be to help extension educators with IPM projects that emphasize environmentally friendly and economically sound pest management methods.

A native of Washington state, Ken has a BS in Agricultural Education from Washington State University, a MS in Agricultural Education and Extension from Iowa State, and a MS in Entomology from University of Idaho. Ken was an extension educator in Latah county, Idaho and taught agricultural technology at Dickinson State University in North Dakota and high school in Oakville, Washington. Ken's office is in the Schoharie county CCE office, 41 South Grand Street, Cobleskill, NY 12043-1696. He can be reached at 518-234-4303, or by e-mail at: klw24@cornell.edu.

Calendar of Events

June 13, 2000	Small Grain Field Day, Aurora, NY
June 18-21	Northeastern Branch ASA and SSSA Annual Meeting, Newark, DE
August 12-16	American Phytopathological Society Meeting, New Orleans, LA
October 24	Field Crop Dealer Meeting, Clifton Park, NY
October 25	Field Crop Dealer Meeting, New Hartford, NY
October 26	Field Crop Dealer Meeting, Batavia, NY
October 27	Field Crop Dealer Meeting, Waterloo, NY
November 1-3	Northeast Division of American Phytopathological Society Meeting, Cape Code, MA
November 5-9	ASA-CSSA-SSSA Annual Meeting, Minneapolis, MN

What's Cropping Up? is a bimonthly newsletter distributed by the Department of Soil, Crop and Atmospheric Sciences at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Soil, Crop and Atmospheric Sciences, Plant Breeding, Plant Pathology, and Entomology. **To subscribe, send a check for $8.00 along with the form at the right.**

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