



IPM
Planning Guide

instructions

IPM Planner Instructions

Presented by the



**Environmental
Institute for Golf**

The philanthropic organization of **GCSAA** 

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What is the IPM Planner?

Your completed IPM Planner represents the culmination and final step of your IPM planning process. In a single sheet of paper, it summarizes the complex interactions among forces such as climate, pests, turf growth and golf play, and demonstrates the science and logic on which your IPM agronomic practices are based. You will need to develop a separate IPM planner for each of your management zones.

What is the IPM Planner used for?

- The blueprint for your annual IPM plan
- A planning, communication and organizing tool for scheduling, purchasing, budgeting and coordinating
- A communication tool for explaining the science and logic behind your IPM strategies to your staff, management, golfers and other superintendents

Estimated time involved: 2-3 hours per management zone

Materials needed:

Completed forms and worksheets

- Completed Climate Appraisal Form
- Completed Pest Worksheet Form
- Completed Management Zones Inventory Form

Forms:

- An IPM Planner Form for each of the management zones on your golf course.

Examples:

- Sample IPM Planners have been provided for guidance.

References:

- Monitoring Salinity
- Pesticide Resistance Management
- Using Threat Temperatures for IPM Planning
- Using Growth Potentials for IPM Planning
- Pest References on each targeted pest
- Turf Sensitivity to Herbicides

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You will need to complete a separate IPM Planner Form for each of the management zones that you have identified in your Management Zone Inventory.

I. Map periods of turf stress

1. On your IPM Planner form, use a yellow highlighter (or yellow shading tool if using the electronic form) to indicate periods of high- or low-temperature stress for cool-season turf and warm-season turf. These periods should also be highlighted in yellow on your Climate Appraisal Form. If you are managing only cool-season turf on your greens, then you can ignore the warm-season turf data (and vice versa).
2. If there are months where persistent overcast, cloudy or rainy weather (more than 5 inches per month) results in stress to your turf, highlight them in yellow on the warm-season or cool-season turf stress line (if they aren't already highlighted due to suboptimal air temperatures).
3. Mark a "T" to indicate planned tournament dates on either the cool- or warm-season stress lines.

II. Schedule agronomic practices

Mark an "X" to schedule cultural practices such as those listed below. Avoid scheduling aggressive agronomic practices (aeration, heavy topdressing, vertical mowing) during the highlighted periods of stress/slow growth:

- Tree maintenance: trimming, lacing and/or removal should be scheduled during months of low-light intensity (typically, fall/winter) to increase solar radiation in areas that are stressed due to shade.
- Renovation
- Overseeding
- Aeration (specify type used: deep tine, Vertidrain, etc.): in most cases, at least 1x per year
- Heavy topdressing
- Venting (recommended: ¼-inch solid tines or deep slicing with equipment such as Planet Air, monthly during periods of active turf growth [>30 percent growth potential])
- Grooming
- Vertical mowing
- Light topdressing
- Traffic control

III. Schedule soil nutrition

On your IPM Planner Form, mark an “X” to schedule the following:

1. **Soil testing** (2x per year in spring and fall)

2. **Nitrogen applications:**

- Determine the type of nitrogen product and the weekly rate of application, and write this information in the columns just to the right of the “nitrogen” line on your IPM Planner Form. Use a different line for each different nitrogen product. To calculate the optimal N rate of application, follow these steps:
 1. **Find the maximum rate of elemental N/month for your location** by looking at the cool- or warm-season monthly N requirements listed on your Climate Appraisal Form. Keep in mind that this rate will be converted (later on in this exercise) into the rate of product needed to deliver the specified amount of elemental N.
 - a. Keep in mind that the nitrogen rates shown in the Climate Appraisal Form are the maximum amounts that should be used at your location. In other words, these are the amounts that should not be exceeded. For this reason, you may want to use lower rates than those shown in the Climate Appraisal Form.
 - b. How do you determine how much to lower the rates (if at all) shown in the Climate Appraisal Form? The authors have assumed that 0.7 lb. elemental N/1,000 sq. ft./month is the maximum that should be used when the turf is growing at full capacity. If this is a higher rate of nitrogen than you use during the peak growth months, then you should decrease all of the amounts shown in the Climate Appraisal Form accordingly. For example, if the maximum rate of elemental N you have applied (with good results) is 0.5 lb. elemental N/1,000 sq. ft./month, then all nitrogen values in the Climate Appraisal Form should be decreased to 71 percent of the printed value ($0.5/0.7 = 71.4\%$).
 2. **Determine the weekly rate of elemental N by dividing the monthly rate by 4.** In the example above, a monthly rate of 0.5 lb. elemental N/1,000 sq. ft./month becomes 0.125 lb./1,000 sq. ft./week.
 3. **Determine the weekly rate of nitrogen product that will be applied.** To do this, you will need to know the percentage of elemental nitrogen in the fertilizer product you have selected. In the sample IPM Planner that the authors have provided, urea, 45-0-0, has been selected as the nitrogen source. And, for this example, it has been decided to never apply more than 0.5 lb./1,000 sq. ft. elemental N/month (0.125 lb./1,000 sq. ft./week). Therefore, to calculate the amount of product needed to deliver 0.125

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lb./1,000 sq ft elemental N per application, divide 0.125 lb. by 45 percent (0.125/0.45) to obtain a rate of 0.28 lb./1,000 sq. ft. of urea per application.

4. **Finally, determine the frequency of application by marking an “X” for each week that an application is planned.** Remember that the number of applications you make each month (anywhere from 0 to 4), will be determined by the maximum monthly amount you want to apply.
 - a. ***Note on nitrogen demand in heavy rainfall or low nutrient-holding soil (sandy, low TEC) areas:*** In areas that experience heavy rainfall (more than 5 inches per month), or 100 percent sand greens, maintaining nitrogen levels at adequate levels is a challenge. Under these conditions, the maximum rates of 1 lb. elemental N/1,000 sq. ft./month may need to occasionally be exceeded. Consider the use of granular, long-chain ureaformaldehyde nitrogen sources such as Nitroform 38-0-0. These microbial-release fertilizers are less likely to be leached by rainfall than other N sources. If these products are used, higher rates (2 - 4 lbs. nitrogen/1,000 sq. ft. or more) are optimal. Because these rates are higher than those listed on your Climate Appraisal Form, application will be less frequent. Reapplication should occur based on turf performance and color.
 - b. ***Note on overseeded turf:*** If you are managing both cool- and warm-season turf in an overseeding situation, select the nitrogen rate based on the turf type whose growth you are trying to encourage. For example, if you are trying to promote growth of cool-season turf during the wintertime, then use the nitrogen rates for cool-season turf that are suggested on the Climate Appraisal Form. If you are trying to encourage both types of turf to grow, then use the higher of the two nitrogen rates shown on your Climate Appraisal Form.

3. Schedule monthly applications of potash as a potassium source at 1 lb. K_2O /1,000 sq. ft. when turf is growing actively (a growth potential of 30 percent or higher). Remember to include the amount of potash applied via your nitrogen source in your calculations to determine whether additional potash is necessary. On the sample IPM Planner, the authors have selected potassium sulfate, 0-0-50, as the potassium source. Since the urea fertilizer the authors selected as an N source contained no potassium, the full pound of potash must come from the 0-0-50. Since the 0-0-50 contains 50 percent potash, we will need $1 \text{ lb.}/0.50 = 2.0 \text{ lbs.}/1,000 \text{ sq. ft.}$ of 0-0-50 to meet the requirement for 1.0 lb. potash per month.

4. Schedule any other nutrient applications that your soils require in blank lines on the management plan.

IV. Schedule water/irrigation management

1. Incorporate leaching and salinity monitoring activities (of particular importance for areas with low rainfall and/or poor-quality irrigation water).
2. Using your IPM Planner Form:
 - a. On the lines “Leaching” and “Salinity Monitoring,” use a yellow highlighter (or yellow shading option in Microsoft Excel) to indicate those months with less than 0.5 inches of rainfall (monthly precipitation can be found on the Climate Appraisal Form). These months represent additional times of stress for the turf.
 - b. During these months, you should schedule weekly salinity monitoring (using an EC meter as described in the “Monitoring Salinity” reference), which can be indicated with an “X” on the “Salinity Monitoring” line.
 - c. Schedule leaching events during these low rainfall months in order to avoid salt accumulation to turf damaging levels. Use your past history to determine the frequency of leaching for the coming year, and indicate with an “X” on the “Leaching” line. If there are no records of past leaching schedules available, then assume that you will need to leach roughly every 14 days during low rainfall months.
3. Mark an “X” to schedule irrigation water testing at least once per year. A higher frequency of testing may be required if the water source is of variable quality (i.e., recycled or reclaimed water).
4. Use “X”s to schedule monthly maintenance of the irrigation system -- level heads, check pressure, use catch cans to identify problems
5. Use “X”s to schedule drainage improvements in poorly drained areas during time periods compatible with other management and golfer-oriented events.
6. Schedule hand-watering during heat stress periods.

V. Schedule aerial photography

On your IPM Planner Form, use an “X” to schedule annual aerial photographs during the times of heaviest stress. These can be useful for identifying problem areas, as well as documenting changes in overall turf quality over time.

Congratulations! You have just successfully completed the first half of your IPM Planner. This is a good time to take a look at the work you have done (this is why you used a pencil and/or a computer to enter your initial data) and look for any conflicts in your schedule. For example, are any of your agronomic practices scheduled too close

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to tournaments? Are there practices scheduled for separate days that it would be more efficient to schedule for the same day?

VI. Insect IPM

Using the information on your completed Pest Worksheet and in the Pest References, do the following for each of your target insects:

1. **Select IPM strategies for preventively controlled insects.** Begin by focusing on the most important of the preventively controlled insects that you have listed on your Pest Worksheet. Go through the entire process described below for one insect at a time.
 - a. Using the Pest References that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled insect that you have listed on your Pest Worksheet.
 - b. List the names of these products or practices on the IPM Planner Form. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.
 - c. Use the most current product labels to determine the rate you plan to use, and indicate this rate on the IPM Planner Form as well. If there are any specific application guidelines (volume of application, watering-in requirements, nozzle types, etc.) identified on the product label or in your Pest References, make a note of these next to each product name.
 - d. Use the letter “X” to indicate the timing of application for each of the products or practices. Consult your Pest Worksheet for information on when to initiate applications. Consult product labels for frequency of follow-up applications, and indicate these applications with additional “X”s.
 - e. Go through the same procedure for the remaining preventively controlled insects.
2. **Select IPM strategies for curatively controlled insects.** For these insects, it is almost impossible to predict exactly when control measures will be necessary – their timing will be based on when the insects are detected in your monitoring program. For this reason, the most important activity you can schedule for curatively controlled insects is monitoring.
 - a. Using the Pest References for each of your target insects, determine at which temperatures monitoring for each insect should occur (note that monitoring isn’t absolutely necessary for those insects that are habitual problems and are preventively controlled).

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- b. Using your Climate Appraisal Form, determine when those monitoring temperatures begin.
 - c. Now, on your IPM Planner Form, write the name of the monitoring practice in the left-hand column, and place an “X” at the time the practice should begin. Place additional “X”s roughly every two weeks during the insect’s threat period.
 - d. Follow steps 1a -1c above for each curatively controlled insect.
 - e. For purposes of budgeting and/or planning, you may want to make some rough estimates on when control measures for curative insects will be made. Your records from previous years may be the most helpful in this respect – you can mark a tentative “(X)”, in parentheses to indicate it’s based on last year’s data, on the dates when you performed control measures last year. You will also find a listing of control measures at the end of the Pest Reference for each of your targeted insects.
 - f. Go through the same procedure for the remaining curatively controlled insects.
3. **Identify target insects.** It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the insect pest (I1-I5) on your Pest Worksheet and enter it on your IPM Planner Form next to each management or monitoring practice that it addresses. Some practices will probably target multiple insect pests.
 4. **Refine your program.** Now take a look at your insect management program. Can you streamline the program any further by targeting two or more insects with the same product or practice? Or by moving application dates around by one or two weeks? Are you targeting the right insect life stage with the right product? Have you taken into account resistance management guidelines, which recommend that you rotate among insecticide classes (see the “Insecticide Resistance Management” section in the Insect reference)? Don’t become frustrated if you do a lot of erasing during this step – the idea is to get you to try out on paper several scenarios, and then judge which is the most efficient, most economically attractive, and most effective.

VII. Disease IPM

Using the information on your completed Pest Worksheet and in the Pest References, do the following for each of your target diseases:

1. **Select control measures for preventively controlled diseases.** Begin by focusing on the most important of the preventively controlled diseases that you have listed on your Pest Worksheet. Go through the entire process described below for one disease at a time.
2. Using the Pest References that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled disease that you have listed on your Pest Worksheet.

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- a. List the names of these products or practices on the IPM Planner Form. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.
 - b. Use the most current product labels to determine the rate you plan to use, and indicate this rate on the IPM Planner Form as well. If there is a choice in spray interval frequencies, the 14-day interval (with the 14-day rate recommendation) is usually optimal. If there are any specific application guidelines (volume of application, nozzle types, watering-in requirements, etc.) identified on the product label or in your Pest References), make a note of these next to each product name.
 - c. Use the letter “X” to indicate the timing of application for each of the products or practices. Consult your Pest Worksheet for information on when to initiate applications. Consult product labels for frequency of follow-up applications and indicate these applications with additional “X”s.
 - d. Determine optimum product placement by consulting the Pest Reference for each specific disease. For each product, write an “S” for soil applications or an “F” for foliar applications. Foliar or crown placement relies on low-volume applications of 1-2 gal./1,000 sq. ft., while soil (root) placement relies on higher volume applications of 2-4 gal./1,000 sq. ft. (or low-volume applications watered in with approximately 0.1 inches of irrigation).
 - e. Go through the same procedure for the remaining preventively and curatively controlled diseases. Remember that the timing for curatively controlled pests is going to be a rough estimate at best – you will want to use monitoring to confirm that curatively controlled diseases are present before beginning control measures.
3. **Monitoring.** Follow the guidelines for monitoring practices and timing in each of the Pest References. Write the name of the monitoring practices that you want to implement in the left-hand column of your IPM Planner Form, and place an “X” at the time you should begin. Place additional “X”s roughly every two weeks during the disease’s threat period.
 4. **Identify target diseases.** It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the disease (D1-D5) on your Pest Worksheet and write it down on your IPM Planner Form next to each management or monitoring practice that it addresses. Some practices will probably target multiple diseases.
 5. **Refine your program.** Now take a look at your disease management program and refine it as you did your insect program. Also, make sure that the disease threat periods are sufficiently covered by your control measures. Remember that in many cases, preventive control practices will also control diseases that are listed for

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curative control. Have you taken into account resistance management guidelines, which recommend that you rotate among fungicide classes (see the “Fungicide Resistance Management” section at the end of the Disease reference)?

VIII. Weed IPM

Using the information on your completed Pest Worksheet and in the Pest References, do the following for each of your target weeds:

1. **Select control measures.** Begin by focusing on your most important pre-emergence controlled weed that you have listed on your Pest Worksheet. Go through the entire process described below for each weed.
 - a. Using the Pest References that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled weed that you have listed on your Pest Worksheet. Remember to take into account the sensitivity of your specific turf type to each weed control product (see “Turf Sensitivity to Herbicides” reference).
 - b. List the names of these products or practices on the IPM Planner Form. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.
 - c. Use the most current product label versions to determine the rate that you plan to use and indicate this on the IPM Planner Form as well. If there are any specific application guidelines (volume of application, watering-in requirements, nozzle types, etc.) identified on the product label or in your Pest References, make a note of these next to each product name.
 - d. Use the letter “X” to indicate the timing of application(s) for each of the products or practices. Consult your Pest Worksheet for information on when to initiate applications. Consult product labels and your Pest References for frequency of follow-up applications and indicate these applications with additional “X”s. Make sure that product residual activity is long enough to control each target pest.
 - e. Complete the same procedure for the remaining pre- and then post-emergent controlled weeds. Remember that the timing for post-emergence weeds is going to be a rough estimate at best – you will want to use monitoring to confirm that these weeds are present before beginning control measures
2. **Monitoring.** Monitoring is especially important for weeds that are controlled post-emergence. Write the name of the monitoring practices that you want to implement (for post-emergent weeds, it is usually “visual monitoring”) in the left-hand column of your IPM Planner Form. Use your Climate Appraisal Form and the Pest Reference for each weed to determine when visual monitoring begins. Mark with an “X” on the IPM Planner Form at the time you should begin monitoring, and place additional “X”s

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roughly every two weeks for as long as conducive temperatures are forecasted to exist in your Climate Appraisal Form.

- 3. Identify target weeds.** It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the weed (W1-W5) on your Pest Worksheet and write it down on your IPM Planner Form next to each management or monitoring practice that it addresses. Some practices will probably target multiple weeds.
- 4. Refine your program.** Now take a look at your weed management program and refine it. In addition, make sure that you have taken overseeding timing and turf sensitivities (“Turf Sensitivity to Herbicides” reference) into account. Have you incorporated resistance management guidelines, which recommend that you rotate among pesticide classes (“Herbicide Resistance Management” section at the end of the Weed reference)?

IX. Other pests

Pests that cannot be classified as insects, diseases or weeds can, of course, still be important pests. Birds and rodents fall into this category, for example. To include these “other” pests in your plan, follow the instructions under Section VII (Diseases) and modify as necessary, depending on the pest in question.

X. Review your planner

The next-to-final step in this process is to look over your entire IPM Planner Form and make any necessary adjustments. Some of the questions you should be asking yourself include:

- Am I taking full advantage of cultural practices in order to maximize turf health and potentially reduce pesticide applications?
- Are there stressful practices (aeration, products with risks of phytotoxicity, products that cause damage when air temperatures are high) scheduled during especially stressful periods of time for the turf? Can the procedure be rescheduled and/or gentler products substituted?
- Can products that are scheduled for application at similar times be safely mixed in the spray tank?
- Am I in compliance with all labels, regulations, laws and recommendations?
- For overseeding, are products and practices timed to avoid any scheduling conflicts with renovation and overseeding procedures?

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Congratulations! You are done!

Your time and effort will pay off in improved planning, organization, coordination and communication.

NOTE: When developing your insect, weed or disease plans, always consult the most current version of all product labels and confirm that your plan is within the manufacturer's labeled guidelines.