Crop Profile for Pepper (Sweet) in Ohio

(Solanaceae, *Capsicum annum*)

Prepared: December, 1998
Revised: February, 2004

General Production Information

Acres in Ohio:	1700 (1)
Percent of US Acreage/Rank:	1.6%/8th (2)
Number of Growers:	409 (2)
Per Acre Value:	4,423 (1)
Value of Production:	4,423,000 (1)

Location of Production

Sweet peppers are primarily produced the northern (Stark, Henry, Wood and Huron counties) and the southeastern (Washington and Meigs counties) parts of the state.

Production Method (3)

Peppers are a warm season crop, which produce best during a long growing season. They are very sensitive to temperature extremes, preferring an average daytime temperature of 75° F and an average nighttime temperature of 62° F. Peppers grow well in a loam or sandy loam soil, with a pH between 6.0 and 6.8. Acid soils can lead to calcium and magnesium deficiencies and fruit damaged with blossom end rot. Peppers are usually planted in Ohio as greenhouse grown, plug transplants. The ideal planting date for transplants is mid to late May, but is typically delayed due to spring rainfall. Transplants should be only slightly hardened before planting. Over hardened transplants are slow to develop once in the field. Transplants should be set with a starter fertilizer high in phosphorus. Transplants are placed in rows 4 feet apart with 12-18 inches between plants. Many growers of fresh-market peppers in Ohio, plant under black plastic mulch with trickle irrigation laid under the plastic. This provides uniform moisture and fertility during the growing season. A constant water supply is necessary for adequate production. Bell peppers are harvested either when immature and green but have reached full size and maximum wall thickness, or when fully ripened and turned red. Sweet peppers in Ohio are produced for both the fresh (green peppers) and processing (red peppers) markets. A good yield should be 800-1000 bu/A.

Major Insect, Mite and Nematode Pests (4)

Insect, Mite, or Nematode Pest	*Frequency of Occurrence*	*Damage Caused By Pest*	*Critical Timing of Control*
European Corn Borer	Yearly (2-3 generations); 1st-rare, 2nd-common, 3rd occasional, most common in years of warm temperatures.	Larvae tunnel into fruit near fruit crown. Cause internal damage, premature ripening, and vulnerability to secondary pathogen infection.	2nd generation-late July to early September; 3rd generation-mid-September to mid-October.
Beet Armyworm	Rare. When infestations do occur, damage is severe.	Larvae feed on and in fruit causing large cavities that ruin fruit and allow for secondary disease infection.	August through October.
Aphids	Common. Populations are typically not severe.	Leave sticky residue on fruit; a growth medium for pathogens. Can transmit potato Y virus.	Control when pest density is high enough to cause noticeable honeydew deposits.
Fall Armyworm	Sporadic. Infestations can be severe.	Larvae feed inside fruit causing internal damage that allows for secondary disease infection.	September through October.
Corn Earworm	Sporadic. Most infestations are mild, but may be severe in some years.	Larvae feed inside fruit causing internal damage that allows for secondary disease infection.	September through October.
Flea Beetle	Common. Infestations generally mild, and do not require control, if plants are vigorous.	Adults feed on leaves, leaving small holes.	May through June.
Tomato Hornworm and Tobacco Hornworm	Common. Usually occurs in low density, and does not require control.	Adult feeds on leaves, usually in the upper region of the leaf canopy, and grazes on fruit surface.	July through August.

Stink Bug	Sporadic.	Adults and nymphs suck sap from fruit, leaving a white or yellow blotch.	August through September.
Whitefly	Occasional.	Nymphs suck sap from leaves, and deposit honeydew, which may attract sooty blotch disease pathogens.	Control when pest occurs in damaging numbers.

Ohio Insecticide Usage Data on Sweet Pepper: 2002[2,3]

**Insecticide/ Formulation*	*% Crop Treated*	*Application Type*	*Application Rate*	*# Of Apps. / Season*	*PHI*	*REI*
Acephate (Orthene)	77%	Foliar	0.08 lb/A	2.6	7 days	24 hours
Endosulfan (Thiodan)	54%	Foliar	0.61 lb/A	1.4	1-4 days	24 hours
Permethrin (Pounce/ Ambush)	44%	Foliar	0.02 lb/A	7.7	3 days	12 hours
Carbaryl (Sevin)	5%	Foliar	1.01 lb/A	1.8	3 days	12 hours

*Usage data has not been published for the following active ingredients. Cumulatively, these insecticides make up 38.2% of total pounds applied in 2002: Azinphos-methyl, Bifethrin, *Bacillus thuringiensis*, Carbofuran, Chlorpyfiros, Cyfluthrin, Diazinon, Dimethoate, Esfenvalerate, Ethyl parthion, Imidacloprid, Malathion, Methomyl, Piperonyl butoxide, Pyrethrins, Spinosad, and Tebufenozide.

Alternative Chemicals [5]

Common Insecticide	*Efficacy*	*Common Pest Targeted*	**Available Alternative Insecticides*
Acephate (Orthene)	Excellent	European Corn Borer	Pyrethroids (Pyrenone) (ü), Pyrethrins +Rotenone (Pyrellin) (ü)

Endosulfan (Thiodan)	Good	Aphids	Dimethoate (Cygon), Disulfoton (Di-Syston), Oxydemetonmethyl (Metasystox-R), Acephate (Orthene), Methomyl (Lannate), Thiamethoxam (Actara/ Platinum), Imidacloprid (Admire/Provado), Acetamiprid (Assail), Pymetrozine (Fulfill), Endosulfan+Pyrethrins (Thirethrin)
Permethrin (Pounce/ Ambush)	Good	European Corn Borer	Cyfluthrin (Baythroid), bifenthrin (Capture), zetacypermethrin (Mustang), Spinosad (SpinTor), Tebufinozide (Confirm)
Carbaryl (Sevin)	Good	Flea Beetle	Endosulfan (Thiodan), Permethrin (Ambush/ Pounce), Esfenvalerate (Asana), Bifenthrin (Capture), Zetacypermethrin (Mustang), Thiamethoxam (Actara/Platinum), Pyrethrins (Pyrenone), Pyrethrins+Rotenone (Pyrellin)

*Alternatives are at least equally effective against common pest targeted, unless otherwise noted

ü = Sufficient efficacy data is not available; Product is labeled for this pest and crop

Biological Insect, Mite and Nematode Control Practices (5)

Conservation of Natural Enemies: Maintaining populations of natural pest enemies can, in most cases, provide adequate control of aphids, hornworms, and mites. Selecting insecticides that are known to have little disruption of natural enemies is recommended, when possible.

Cultural Insect, Mite and Nematode Control Practices (5)

Cultivar Selection: Selecting cultivars with known resistance to viruses is highly effective in controlling the vectoring activity of aphids and thrips, lessening the need for direct insect control.

Soil Insecticide: A soil insecticide at planting can achieve moderate control of cutworms.

Pheromone and Black Light Traps: Pheromone and Black Light traps can be used to monitor the activity of adult European corn borers, fall armyworms, beet armyworms, and corn earworms. When moth numbers reach respective threshold, plants can be scouted intensively for larvae, which can determine the need for sprays. Most states provide published trap data.

Scouting: Cutworms, flea beetles, aphids, hornworms, pepper maggot, mites, stinkbugs, and whiteflies can be scouted throughout the growing season to determine the need for insecticide sprays.

Planting Location: Planting peppers near both early and late plantings of corn (a preferred host of European corn borer,

and corn earworm) can lessen pest pressure in pepper crop.

Post-Harvest Insect, Mite and Nematode Control Practices (5)

Residue Eradication: Residue of pepper and corn crops provides overwintering habitat, especially for flea beetles and European corn borer, and should be eradicated to lessen populations in the following season.

Major Diseases

(6)

Disease	*Frequency of Occurrence*	*Damage Caused By Pest*	*Critical Timing of Control*
Bacterial Spot	Annual. Crop damage may be severe under conditions of high temperature and abundant moisture.	Foliar, necrotic lesions, and defoliation. Blister-like fruit lesions.	Seed and seedlings must be pathogen-free. Bacterial spot is very difficult to control once it becomes established in the field.
Phytophthora Blight	Annual. Crop loss is most common in low-lying, poorly drained areas. Disease thrives in conditions of high temperature, excessive rainfall and standing water.	Damping-off of infected seedlings. Older plants may incur root rot, stem canker, leaf blight and/or fruit rot.	Care should be taken to avoid introducing the pathogen into a clean field, as it will persist for at least five years. Fungicides must be applied close to planting date, if the field has a history of the disease.
Anthracnose	Care should be taken to avoid introducing the pathogen into a clean field, as it will persist for at least five years. Fungicides must be applied close to planting date.	Circular, sunken lesions on fruit. Small, necrotic lesions on leaves.	Throughout fruit production.

Bacterial Soft Rot	Annual. Pre-harvest and Post-harvest losses result from bacterial infection of fruit through wounds.	External depression, followed by softening of internal fruit tissue.	Insect pests that cause fruit wounding must be controlled during period of fruit production.
White Mold	Common. Thrives in conditions of cool temperatures and high moisture.	Stem cankers on seedlings and mature plants; fruit rot, and leaf blight.	Fungicides should be applied when environmental conditions favor the disease.
Cucumber Mosaic Virus (CMV)	Occasional. Generally not severe.	Malformed, discolored fruit and foliage. Transmitted by the green peach aphid.	Chemical means of virus control are not currently available. Aphid control is the only available means of virus reduction.
Tomato Spotted Wilt Virus (TSWV)	Rare. Significant losses may occur in plants infected during seedling production.	Stunted growth, and fruit lesions with red and yellow concentric rings. Transmitted by thrips to transplant seedlings.	Control Thrips during transplant production.

Ohio Fungicide Usage Data on Sweet Peppers: 2002 [2,3]

**Fungicide/ Formulation*	*% Crop Treated*	*Application Type*	*Application Rate*	*# Of Apps. / Season*	*PHI*	*REI*
Copper Hydroxide (Kocide/ Champ)	69%	Foliar	0.48 lbs./A	17.9	0 days	24 hours
*****Chlorothalonil (Bravo)***	<1%	Foliar	1.22 lbs./A	3.1	7 days	48 hours

*Usage data has not been published for the following active ingredients. Cumulatively, these fungicides make up 55.2% of total pounds applied in 2001: Azoxystrobin, Benomyl, Copper ammonium complex, Copper oxide,Copper sufate, Mancozeb, Maneb, Mefenoxam, and Thiophanate-methyl

**No longer labeled for use on peppers

Alternative Chemicals [5]

Common Fungicides	*Efficacy*	*Common Pest Targeted*	**Available Alternative Fungicides*
Copper Hydroxide (Kocide/Champ)	Fair	Bacterial Spot	Fixed Copper Solutions (Copper Sulfate, Copper oxychloride, Cuprous oxide), Manganese Ethylene dithiocarbamate (Maneb, Manex)

*Alternatives are at least equally effective against common pest targeted, unless otherwise noted

Biological Disease Control Practices (5)

Biological Control Products: The following products are available and labeled for use on peppers as biological control of certain diseases:

1. Agriphage (antibacterial virus)-controls bacterial spot and bacterial speck.

2. Messenger (Harpin protein)-Induces resistance to bacterial spots, wilts, blights, and certain fungi.

3. Serenade (*Bacillus subtillus*)-Broad spectrum protectant and induced resistance activity.

Cultural Disease Control Practices (5)

Site Selection: Selection of a well-drained site, or implementing improved drainage is very important in control of bacterial leaf spot, *Phytophthora* blight, and *Sclerotinia.*

Crop Rotation: A 4-5 year rotation sites with vine or solanaceous crops in important, especially in *Phytophthora* blight control.

Seed Treatments: Fungicide (Thiram), hot water and chlorine treated seeds can control damping off, bacterial leaf spot, anthracnose, and internal mold.

Drip Irrigation and Plastic Mulch: The use of drip tape irrigation in combination with plastic mulch is a good alternative to overhead irrigation, which can increase water splash. *Phytophthora* blight, bacterial leaf spot, anthracnose, internal mold, and white mold can be lessened by drip irrigation.

Worker Activity: Workers and equipment should not enter the field when plants are wet. Water facilitates the spread of bacterial leaf spot and anthracnose.

Eradication of Diseased Plants: Removal of plants infected with bacterial leaf spot, *Phytophthora* leaf blight and anthracnose reduces inoculum in the field.

Post-Harvest Disease Control Practices (5)

Storage Conditions: Cool temperatures and low relative humidity in storage prevents the activity of the pathogen that

causes fruit rot.

Major Weeds

(*Broadleaves and Grasses*)

Weeds reduce crop yield and quality by competing for light nutrients and water. A combination of chemical, cultural and post harvest practices is necessary for adequate control.

Ohio Herbicide Usage Data on Sweet Peppers: 2002 [2,3]

Herbicide/ Formulation	*% Crop Treated*	*Application Type*	*Application Rate*	*Timing*	*# Of Apps. / Season*	*PHI*	*REI*
Glyphosate (Roundup)	45%	Ground	0.75 lbs./A	Preplant	1.0	56 days	12 hours
Trifluran (Treflan)	26%	Ground, incorporated	0.71 lbs./A	Preplant	1.0	-	12 hours
Clomazone (Command)	14%	Ground	0.34 lbs./A	Preplant	1.0	-	12 hours
Metolachor (Dual)	12%	Ground, broadcast	0.85 lbs./A	Preplant or preemegence	1.0	60 days	12 hours
Napropamide (Devrinol)	3%	Ground, Incorporated	1.41 lbs./A	Preplant	1.0	-	12 hours

Alternative Chemicals [5]

Common Herbicides	*Efficacy*	*Common Pest Targeted*	**Available Alternative Herbicides*
Glyphosate (Roundup)	Good	Broadleaves, Grasses, and Specific Weeds	S-Metalachlor (Dual Magnum), DCPA (Dachtal), Sethoxydim (Poast), Clethodim (Select), Paraquat (Gramoxaone Extra)
Trifluran (Treflan)	Good	Broadleaves and Grasses	S-Metalachlor (Dual Magnum), DCPA (Dachtal), Sethoxydim (Poast), Clethodim (Select), Paraquat (Gramoxaone Extra)

Clomazone (Command)	Good	Broadleaves and Grasses	S-Metalachlor (Dual Magnum), DCPA (Dachtal), Sethoxydim (Poast), Clethodim (Select), Paraquat (Gramoxaone Extra)
Metolachor (Dual)	Fair	Broadleaves, Grasses and Specific Weeds	S-Metalachlor (Dual Magnum), DCPA (Dachtal), Sethoxydim (Poast), Clethodim (Select), Paraquat (Gramoxaone Extra)
Napropamide (Devrinol)	Fair	Broadleaves and Grasses	S-Metalachlor (Dual Magnum), DCPA (Dachtal), Sethoxydim (Poast), Clethodim (Select), Paraquat (Gramoxaone Extra)

*Alternatives are at least equally effective against common pest targeted, unless otherwise noted

Cultural Weed Control Practices (5)

Weed Seed Exclusion: Keep machinery clean, as it may carry weed seed. Also purchase seed with low weed seed content, and weed free soil mixtures.

Cultivation: Cultivation before planting, and between rows during the growing season can reduce weed pressure.

Plastic Mulch: Plastic mulch stops weed growth within crop rows.

Post-Harvest Weed Control Practices (5)

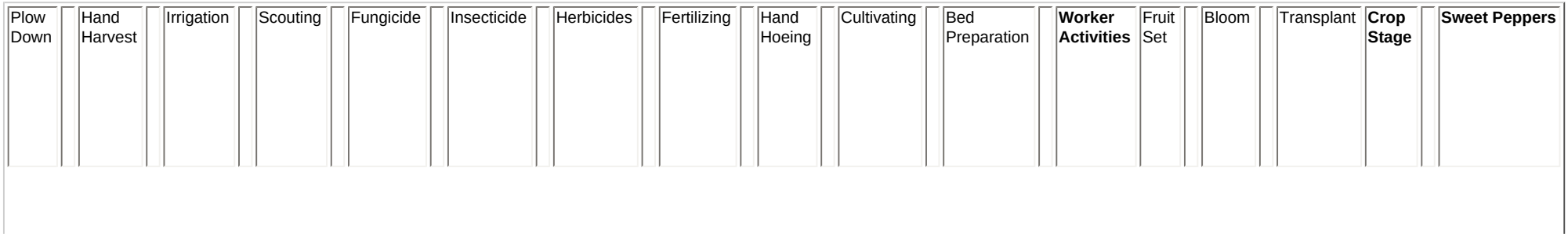
Field Weed Maps: Knowing which weeds are a problem in a given field can make management decisions more effective for the following season.

Spot Sprays: Effective with perennial weeds which may persist after harvest.

Cover Crops: Planting a cover crop in the fall can prevent weed seed emergence in the spring. Eradication of the cover crop can pose problems in the spring.

Crop Production Timeline and Important Worker Activities

Fig. 1 Crop Stages and Worker Activities



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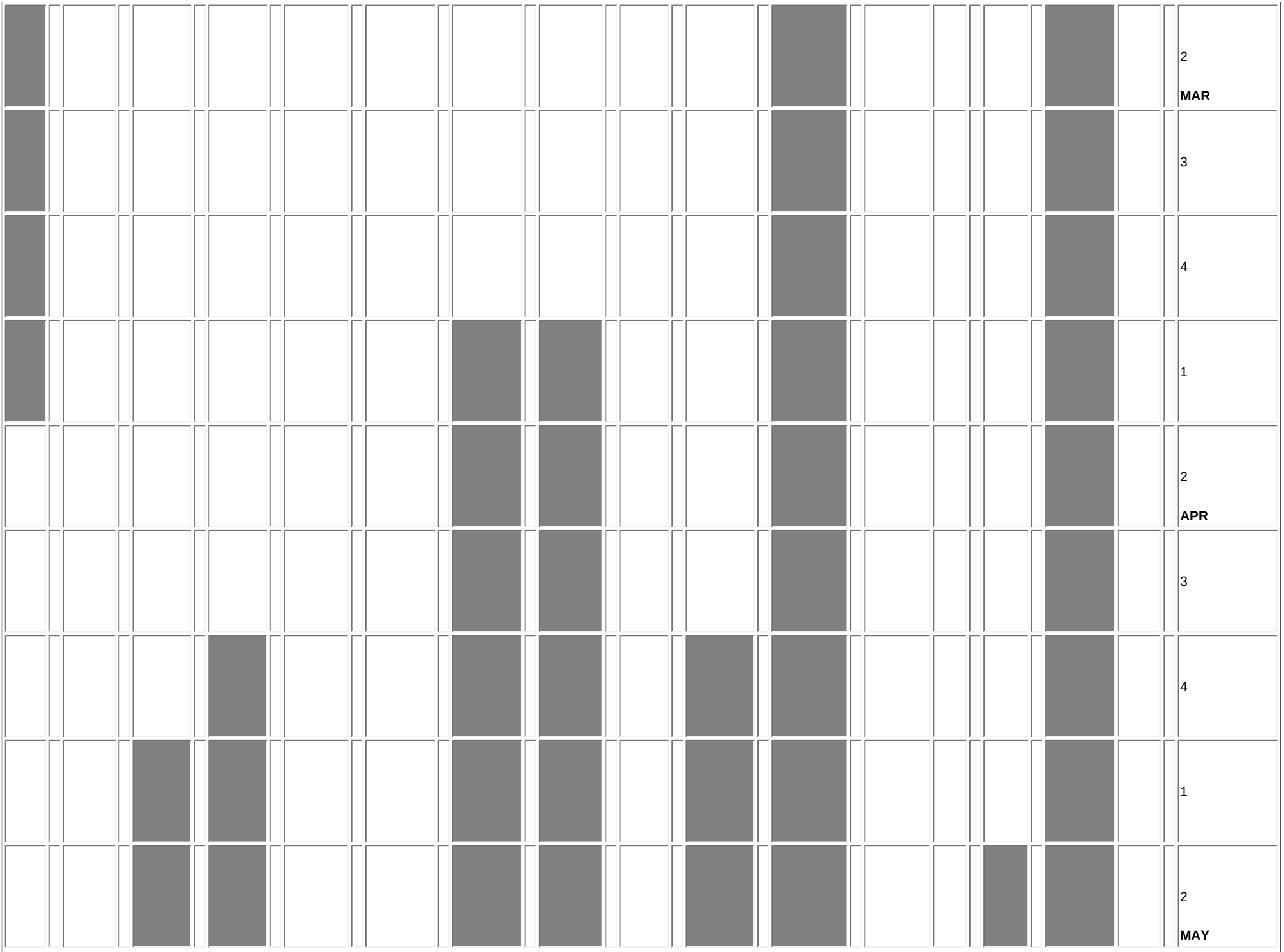
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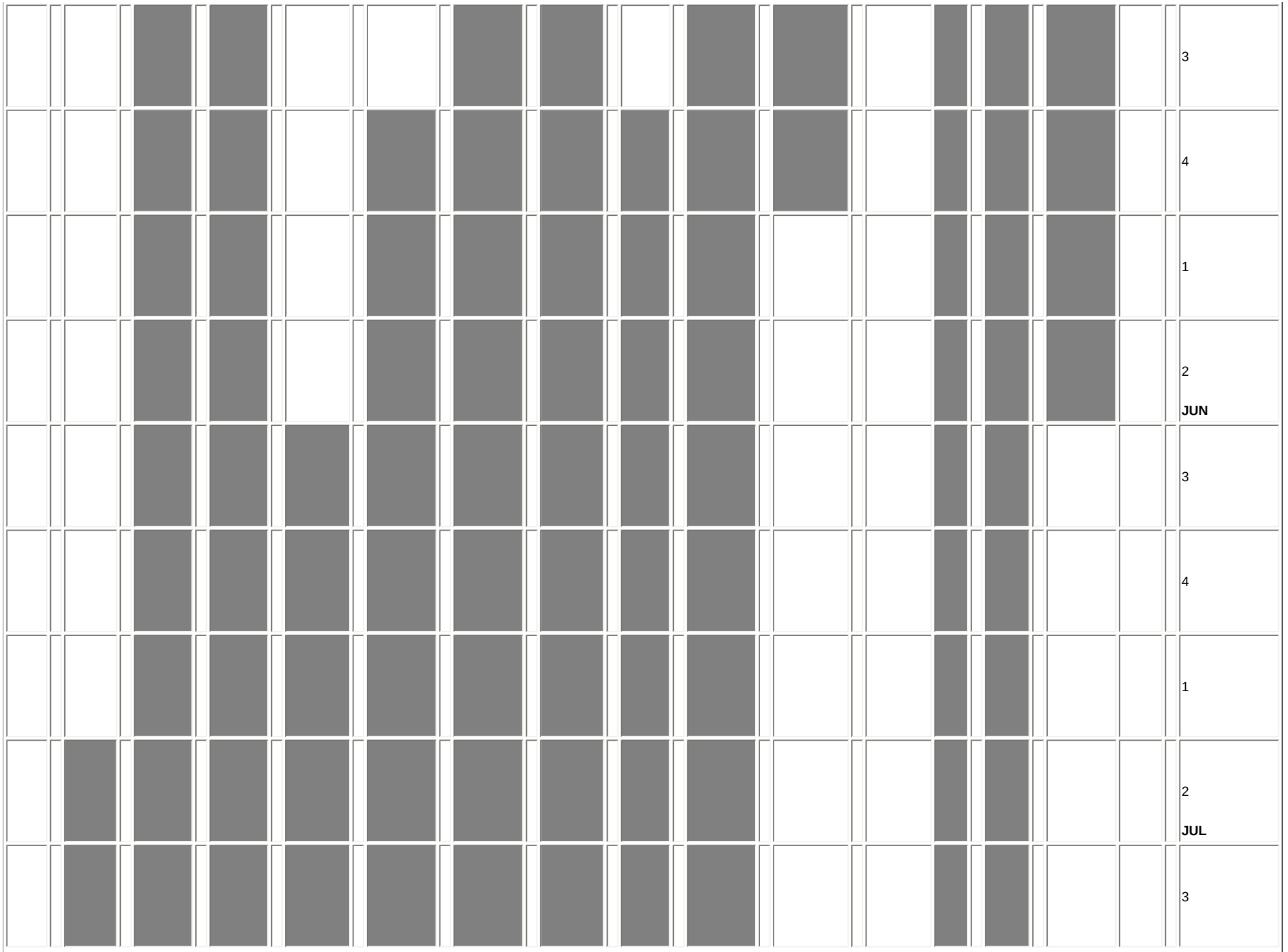
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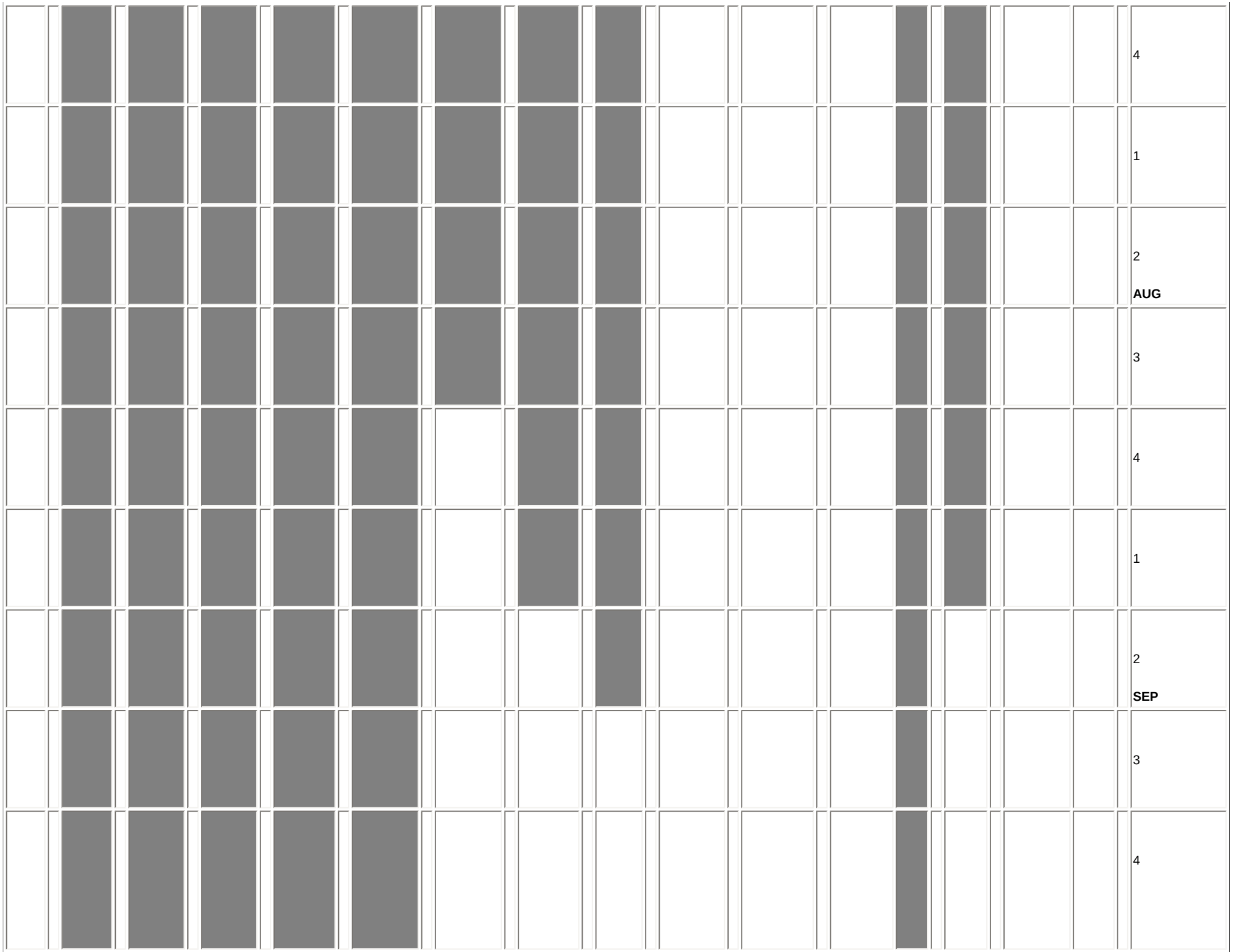
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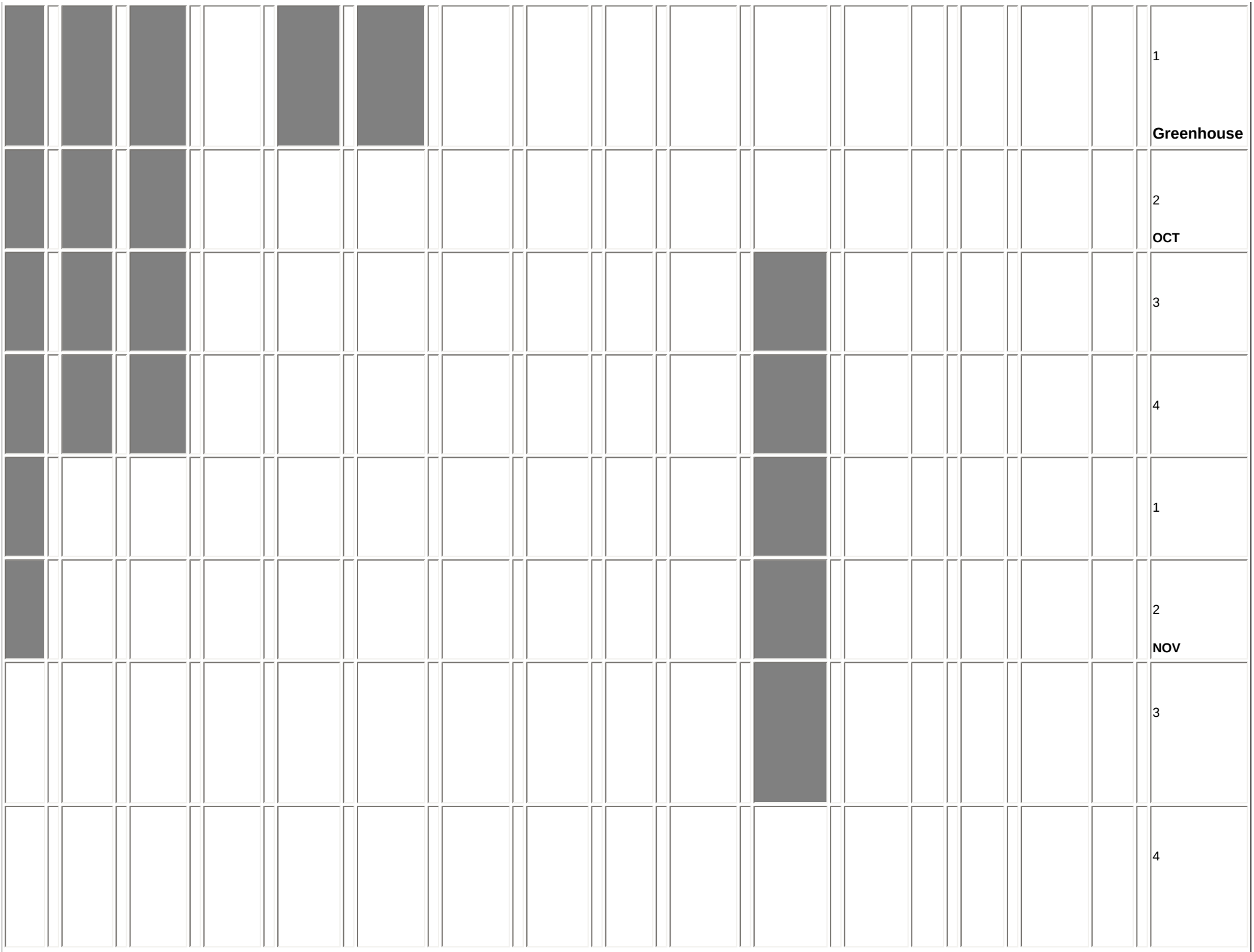
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