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READ SAFETY DIRECTIONS BEFORE OPENING OR USING

BioCrystal™ kurstaki

BIOLOGICAL INSECTICIDE

ACTIVE CONSTITUENT: *BACILLUS THURINGIENSIS* SUBSPECIES *KURSTAKI*, STRAIN HD-1
ACTIVE SOLIDS AND SOLUBLES.

GROUP 11C INSECTICIDE

An aqueous suspension concentrate for control of Bollworm (*Helicoverpa armigera*) and Native Budworm (*Helicoverpa punctigera*) on cotton and field crops and other Lepidopteran caterpillars on agricultural and non-agricultural uses as specified in the Directions for Use.

IMPORTANT: Read this leaflet before use.



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Proudly Australian

BioCrystal™ kurstaki

DIRECTIONS FOR USE:
Restrains:
DO NOT use product if rain is forecast with 8 hours.

SITUATION	PESTS	RATE	CRITICAL COMMENTS
Cotton (NSW, Qld only)	Bollworm (<i>Helicoverpa armigera</i>)	500 mL to 1 L/ha	Pre-Squaring Cotton Apply BioCrystal kurstaki alone at the 500 mL rate for egg pressures up to 10 eggs/m ² and the 1 L rate for egg pressures up to 20 eggs/m ² .
		1.5 to 2 L/ha	Cotton After Start of Squaring Apply with 1.5 to 2 L/ha Protec Plus for egg pressures less than 10 eggs/m ² and larvae less than 8mm in length. Use 500 mL to 1 L Protec Plus per 100 L of spray mix. Use Protec Plus application rate proportional to BioCrystal kurstaki rate.
	500 mL to 1 L/ha + thiodicarb 175g a.c./ha	Eggs and Hatching Larvae Only Use the 500 mL rate for egg pressures up to 30 eggs/m ² and the 1 L rate for egg pressures up to 30 eggs/m ² with hatching larvae present.	
	500 mL/ha + thiodicarb 350g a.c./ha	Larvae up to 8mm Use this mixture for egg pressures up to 30 eggs/m ² with larvae up to 8mm present.	
	500 mL to 1 L/ha + endosulfan 360 to 720 g a.c./ha (ULV 1.5 to 3 L/ ha or EC 1.1 to 2.1 L/ha)	Endosulfan Mixtures Use the lowest rates of BioCrystal kurstaki and endosulfan when egg pressure is less than 20 eggs/m ² , larvae are smaller than 8mm and <i>H. punctigera</i> is the dominant species. Use the higher rates of BioCrystal kurstaki when <i>H. armigera</i> is the dominant species. Use higher rates of endosulfan for higher egg pressures and/or larger larvae.	

SITUATION	PESTS	RATE	CRITICAL COMMENTS
		750 mL to 1 L/ha + Decis* ULV at 2 to 3 L/ha	Pyrethroid Mixtures Use the lower rate of BioCrystal kurstaki and pyrethroid for low egg pressures (less than 10 eggs/m ²), all larvae are very small (less than 3mm) and resistance levels are low.
		750 mL to 1 L/ha + Dominex* 16 ULV at 1.7 to 2.5 L/ha	Use the higher rate of BioCrystal kurstaki as resistance levels increase.
		750 mL to 1 L/ha + Bulldock* 8UL at 1.5 to 2.5 L/ha, or Bulldock* 25EC at 460 to 800 mL/ha	Use the higher rate of pyrethroid for higher egg pressures or larvae larger than 3mm. Consult the relevant pyrethroid labels for directions.
		750 mL to 1 L/ha + Mavrik* ULV at 3.3 to 5 L/ha	Repeat applications as required for control but in accordance with the summer crops insecticide resistance management strategy.
		750 mL to 1 L/ha + Karate* ULV at 2.5 to 3.5 L/ha	
Pulse crops and oilseed crops including: Adzuki Beans, Canola, Chickpeas, Faba Beans, Field Beans, Field Peas, Lentils, Linola, Linseed, Lucerne,	Lepidopteran larvae susceptible to BioCrystal including: Armyworm (<i>Spodoptera</i> spp.) Cotton bollworm (<i>Helicoverpa armigera</i>)	500 mL to 2 L/ha (refer to application section for water volumes)	BioCrystal kurstaki is a highly selective insecticide for use against the listed caterpillars (larvae) of lepidopterous insects. Close scouting and early attention to infestations is highly recommended. Larvae must eat deposits of BioCrystal kurstaki to be affected. Close crop monitoring, timing of applications to the most susceptible pest life stage and thorough spray coverage of the crop are all essential to achieve an efficacious result. Important Note: Users should not expect high levels of efficiency where the optimum conditions (see below) for use are not possible. Users may need to consider alternative control methods where conditions are not optimal or when pest pressure is high and where crops may be sensitive to damage. The suitability of BioCrystal kurstaki as a control measure for each crop should be determined

SITUATION	PESTS	RATE	CRITICAL COMMENTS
Lupins, Mungbeans, Navybeans, Pigeon Peas, Safflower, Soybeans, Sunflower & Vetch	Native budworm (<i>Helicoverpa punctigera</i>) Cabbage moth (<i>Plutella xylostella</i>) Cabbage white butterfly (<i>Pieris rapae</i>)		through consultation with local industry advisors, company representatives or small scale tests before treatment of a large area or number of plants begins. CROP MONITORING: Crops must be monitored regularly for lepidopteran eggs or first instar larvae (small caterpillar stage) to ensure applications can be made at the correct time. APPLICATION TIMING: Time the commencement of spraying to coincide with egg hatch, or treat first instar larvae and before damage to the plant occurs. Applications to later instar larvae or mixed populations of first and late instars are unlikely to produce acceptable levels of control. As larvae must ingest BioCrystal kurstaki for it to be effective, application of BioCrystal kurstaki must be made before larvae move into areas where the spray does not reach (i.e. sheltered positions such as bolls, pods, deep canopy). Application to crops where fruiting structures or dense canopies are present is therefore also not recommended unless good coverage is still possible and some level of crop damage can be tolerated. The activity of BioCrystal kurstaki commences to decline immediately after application. Under continual pest pressure a minimum of 2 sprays separated by no more than 3 days initially and then reapply at 3 - 5 day intervals as required. Spray late in the afternoon or early evening (before dew begins to settle) when larvae are actively feeding. Reapplication after rainfall or overhead irrigation may be necessary.
Sorghum	Green looper (<i>Chrysodeixis eriosoma</i>) Pear looper (<i>Ectropis excursaria</i>) Soybean looper (<i>Thysanoplusia orichalcea</i>) Tobacco looper (<i>Chrysodeixis argentifera</i>)		SPRAY COVERAGE: Thorough spray coverage is needed to provide a uniform deposit of BioCrystal kurstaki at the site of larval feeding. Larvae must be actively feeding on treated, exposed plant parts. Ensure complete and thorough coverage of all plant surfaces. A non-ionic wetting agent such as Protec Plus may need to be used on difficult to wet plants. APPLICATION RATES: Use the higher rates of BioCrystal kurstaki for higher egg laying

SITUATION	PESTS	RATE	CRITICAL COMMENTS
			activity, longer residual or larger first instar larvae. Higher rates should also be used against <i>Helicoverpa</i> spp. Control of <i>Helicoverpa</i> is most effective if larvae are less than 8mm long. Control of <i>Spodoptera</i> is most effective if larvae are less than 15mm long. GENERAL: Larval control is only achieved when the larvae ingest BioCrystal kurstaki and activation begins in the alkaline gut. Feeding ceases once the larvae ingest BioCrystal kurstaki and death of treated larvae may take up to 3 - 5 days. Under low temperatures, when larvae are less actively feeding, control may be slower. BioCrystal kurstaki is safe to beneficial arthropods and is best used in conjunction with these beneficial species (e.g. <i>Trichogramma</i> spp. parasitoids). To obtain maximum assistance from beneficial arthropods, avoid the use of broad spectrum insecticides before and during the use of BioCrystal kurstaki. BioCrystal kurstaki should be used in an Insecticide Resistance Management Strategy.
Agricultural and Non-Agricultural Uses: Oilseeds, Cereals, Vegetables, Fruits, Vines, Tobacco, Herbs, Ornamentals, Forestry, Amenity Trees and Turf	Lepidopteran caterpillars susceptible to BioCrystal kurstaki (BtK), including: Armyworm (<i>Spodoptera</i> spp.) Cotton bollworm (<i>Helicoverpa armigera</i>) Native budworm (<i>Helicoverpa punctigera</i>)	Hectare 500 mL to 2 L/ha High Volume spraying to run-off 25 to 100 mL/100 L Concentrate spraying 100 mL to 1 L/100 L	Monitor crops regularly for lepidopteran eggs or first instar caterpillars. The suitability of BioCrystal kurstaki for control should be determined by consultation with local advisors, company representatives or small scale tests before beginning treatment of large areas or numbers of plants. If BioCrystal kurstaki is suitable, time the start of spraying to coincide with egg hatching or first instar larvae and before damage to the plants. Use the higher rates of application for higher egg laying activity, longer times between applications, larger larvae and against <i>Helicoverpa</i> spp. Control of <i>Helicoverpa</i> is most effective if larvae are less than 8mm long and of <i>Spodoptera</i> if larvae are less than 15mm long. Supplementing BioCrystal kurstaki with other insecticides may be necessary to adequately control larger larvae.

SITUATION	PESTS	RATE	CRITICAL COMMENTS
	Cabbage moth (<i>Plutella xylostella</i>) Cabbage white butterfly (<i>Pieris rapae</i>) Green looper (<i>Chrysodeixis eriosoma</i>) Light brown apple moth (<i>Epiphyas postvittana</i>) Pear looper (<i>Ectopis excursaria</i>) Soybean looper (<i>Thysanoplusia orichalcea</i>) Tobacco looper (<i>Chrysodeixis argentifera</i>) Vine moth (<i>Phalaenoides glyciniae</i>)		Activity of the product starts to decline immediately after application. When there is continual pest pressure or fast plant growth, use at least 2 sprays separated by no more than 3 days initially, followed by re-application at 3 - 5 day intervals. Spray in late afternoon or early evening (before dew begins) when caterpillars are actively feeding. Re-application may be necessary after rain or use of overhead sprinklers. Ensure complete and thorough coverage of all plant surfaces. A non-ionic wetting agent such as Protec Plus may be needed on hard to wet plants. Caterpillars in sheltered positions (e.g. the centre of sweet corn whorls, heart of crucifers and lettuce) will not be controlled. In such cases spraying to achieve run-off may be desirable for the product to reach the target area in order to achieve control. Control is achieved only when caterpillars ingest BioCrystal kurstaki and activation starts in the gut. Feeding ceases upon ingestion after which death may take 3 - 5 days. Control may be slower in low temperatures when larvae are feeding less actively. BioCrystal kurstaki is safe to beneficial arthropods such as <i>Trichogramma</i> spp. parasitoids and is best used in conjunction with them. Maximum assistance from beneficial species requires avoiding the use of broad spectrum insecticides before and during use of BioCrystal kurstaki. BioCrystal kurstaki should be used in an Insecticide Resistance Management Strategy.

**NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL
UNLESS AUTHORIZED UNDER APPROPRIATE LEGISLATION
WITHHOLDING PERIOD: NOT REQUIRED WHEN USED AS DIRECTED WITH BIOCRYSTAL KURSTAKI ALONE.
ENSURE WITHHOLDING PERIODS FOR OTHER INSECTICIDES ARE FOLLOWED WHEN USING MIXTURES.**

GENERAL INSTRUCTIONS

BioCrystal kurstaki is a bacterial insecticide containing live spores and protein endotoxin crystals of the HD-1 strain of *Bacillus thuringiensis (Bt) var kurstaki*. The endotoxin is specifically toxic to the caterpillars of certain lepidoptera (moths and butterflies) and does not harm beneficial insects including bees and parasitic wasps, predatory mites, fish, wildlife or humans. It leaves no harmful crop residues. Bt alone will not control larvae greater than 8 mm in length. Ensure thorough coverage of crop in all cases.

BioCrystal kurstaki causes inhibition of feeding within a few minutes of ingestion by larvae, but does not kill immediately. Thus while the crop is protected from further damage, dying larvae can be expected to be found for several days after spraying.

INSECTICIDE RESISTANCE WARNING

GROUP 11C INSECTICIDE

For insect resistance management BioCrystal kurstaki is a Group 11C insecticide.

Some naturally occurring insect biotypes resistant to BioCrystal kurstaki and other Group 11C insecticides may exist through normal genetic variability in any insect population. The resistant individuals can eventually dominate the insect population if BioCrystal kurstaki or other Group 11C insecticides are used repeatedly. The effectiveness of BioCrystal kurstaki on resistant individuals can be significantly reduced. Since occurrence of resistant individuals is difficult to detect prior to use, Grevillia Ag accepts no liability for any losses that may result from failure of BioCrystal kurstaki to control resistant insects.

BioCrystal kurstaki may be subject to specific resistance management strategies. For further information contact your local supplier, Grevillia Ag representative or local agricultural department agronomist.

Mixing

To ensure homogeneous suspension, if possible agitate containers prior to use by shaking or rolling.

For Ground and Low Volume Aerial Application: Ensure that mixing and/or spray tanks are first emptied of other insecticides and washed out thoroughly. Add water to the tank to 1/2 to 3/4 full or to the level providing maximum agitation. Add a buffering agent when using water with a pH greater than 8.5. Add the required amount of BioCrystal kurstaki to the surface of the water while maintaining agitation. Add Protec Plus if required, any other pesticides and balance of water until the tank is full. Maintain suspension while loading and spraying.

For Ultra Low-Volume: Add BioCrystal kurstaki to spray or mixing tank and start agitation. Add Protec Plus if required, maintaining agitation.

Maintain tank agitation throughout mixing, standing and spraying. Preferably use within 12 hours of mixing. Do not leave diluted BioCrystal kurstaki spray in tanks for more than 24 hours. If spraying is interrupted ensure spray is thoroughly mixed before restarting spray.

BioCrystal kurstaki is formulated for the required coverage and leaf adhesion. Protec Plus should be added to improve performance, particularly on hard-to-wet crops or under conditions of heavy dew or rain.

Application

BioCrystal kurstaki must be ingested, thus thorough spray coverage is essential. Coverage can be improved by using dropper nozzles and fine spray. Do not spray past the point of run-off. Re treatment might be necessary if it rains soon after treatment. Use of broad spectrum insecticides should be avoided during spray programmes with BioCrystal kurstaki, in order to gain maximum assistance from beneficial insects.

Apply at the first sign of newly hatched larvae for the most consistent control. The pest management programme should include frequent scouting with re-application as necessary.

Ground Application: Use the recommended amount of BioCrystal kurstaki in a minimum of 50 L water per hectare.

Low Volume Aerial Application: Use the recommended amount of BioCrystal kurstaki in a minimum of 20 L water per hectare.

Ultra Low-Volume Aerial Application: Use the recommended amount of BioCrystal kurstaki made up with Protec Plus oil to the minimum ULV volume of 4 L/hectare. Higher volumes of application help achieve thorough coverage.

For heavy larval infestations use a higher dose rate and shorter interval between applications. With dense foliage and rapid growth, higher carrier volumes will provide more complete crop coverage and could improve performance. If rapid knockdown of heavy infestations is required, an effective contact insecticide can be included with BioCrystal kurstaki.

In high temperatures larvae develop very rapidly and control requires early application timing.

For it to be effective, BioCrystal kurstaki must be deposited where the larvae feed. If larvae are feeding in the lower 2/3 portion of plants under dense cover, adequate control may not be provided by aerial application.

Note: Effectiveness of BioCrystal kurstaki can be reduced or nullified if pests develop tolerance or resistance to it. If unacceptable control occurs, immediately contact Grevillia Ag. BioCrystal kurstaki should not be used where the user suspects that a tolerant or resistant strain is present.

Compatibility

Except for alkaline products (spray pH > 10.5), common insecticides, acaricides, fungicides, wetting agents, spreaders and adhesives are compatible with BioCrystal kurstaki if mixed in the spray tank and used promptly. Do not apply as a tank mix with, or within 2 days of application of alkaline products including cupric hydroxide, liquid fertilizers, foliar nutrients or Bordeaux mixtures.

Owing to the wide variety of commercial products, we cannot assume any responsibility for mixture compatibility. We recommend that the user do a preliminary compatibility test with the planned mixture in order to observe the physical qualities of the spray and the reaction it might produce on the plants. Some products can also modify the behaviour of larvae.

PRECAUTION

Do not use product mixed for ULV application in ground (handheld or rig) applicators.

PROTECTION OF LIVESTOCK, WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT

Do not contaminate ponds, waterways or drains with BioCrystal kurstaki or used containers.

STORAGE AND DISPOSAL

KEEP OUT OF REACH OF CHILDREN. Store out of sunlight in the closed, original container in a dry, cool, well ventilated place. BioCrystal kurstaki is a biological product that can be damaged by heat, so it should be protected from high temperatures at all times.

Storage temperature of this product is crucial to the stability of this product. It is recommended that BioCrystal kurstaki be stored at less than 5°C. At this storage temperature the product stability is at least 2 years. If BioCrystal kurstaki is stored at temperatures less than 23°C (air conditioning) the product stability is at least 7 months. It is not recommended that this product be stored at temperatures exceeding 23°C for long periods.

Before disposal triple or preferably pressure rinse containers and add rinsings to the spray tank. DO NOT dispose of undiluted product on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If disposing, break, crush or puncture and bury

empty containers in a local authority landfill, or if none is available, bury containers below 500 mm in a specifically marked disposal pit set up for this purpose clear of waterways, desirable vegetation and tree roots. DO NOT burn empty containers or product.

SAFETY DIRECTIONS

Avoid contact with eyes and skin. Do not inhale vapour or spray mist. When opening the container, preparing spray and using the prepared spray wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow length PVC gloves and disposable mist face mask covering mouth and nose. When using the prepared spray wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow length PVC gloves. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves and contaminated clothing.

FIRST AID

If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131 126.

MATERIAL SAFETY DATA SHEET

Additional information is listed in the Material Safety Data Sheet. For a copy phone (07) 3205 1788 or visit our website at www.grevilliaag.com.au

MANUFACTURER'S WARRANTY AND EXCLUSION OF LIABILITY

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