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CONSULTANCY REPORT

ENVIRONMENTAL ASSESSMENT OF PESTICIDE USE FOR THE TECHNICAL AND COMMODITY ASSISTANCE TO THE REPUBLIC OF GEORGIA SUBGRANT

CAUCASUS REGIONAL HUMANITARIAN ASSISTANCE PROGRAM
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Acronyms and Abbreviations

ACDI	Agricultural Cooperative Development International
CICP	Consortium for International Crop Protection
CIP	International Potato Center
CFR	Code of Federal Regulations (U.S.)
CPB	Colorado Potato Beetle
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FAA	Foreign Assistance Act (U.S.)
FAO	United Nations Food and Agriculture Organization
IDP	Internally Displaced Person
IPM	Integrated Pest Management
IPPC	International Plant Protection Center
IRC	International Rescue Committee
LD_{50}	Lethal Dose, expressed in milligrams of active material per kilogram of body weight that will kill 50% of test animals, usually rats
RUP	Restricted Use Pesticides
SCF	Save the Children Federation
TVG	Tri Valley Growers
USAID	U.S. Agency for International Development
WHO	United Nations World Health Organization

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1.0 Executive Summary

This Environmental Assessment examines potential environmental and health-related concerns associated with the proposed use of agrochemicals in two subgrants under the Save the Children's Caucasus Regional Humanitarian Assistance Program. Its purpose is to ensure that the proposed agrochemicals use will satisfy USAID Environmental Procedures (22 CFR Part 216) and that the subgrants will deal effectively with pest/pesticide management activities. In addition, as CARE might seek USAID assistance to acquire Novodor (*Bacillus thuringiensis* var *tenebrionis*) and Decis (deltamethrin) for Colorado potato beetle control in its project implementation areas, this EA also addresses this issue.

The Technical and Commodity Assistance to the Republic of Georgia subgrant is implemented by the Tri Valley Growers (TVG) in collaboration with ACDI. Its purpose is to increase local private sector capacity to produce and market seed and food commodities. Under this subgrant, approximately 200-250 tons of fertilizers (ammonium nitrate), 700 gallons or 5,700 lbs of herbicides (2,4-D and dicamba), and 150 tons of wheat seed will be procured in the U.S., Turkey, and Ukraine and distributed to participating farmers to sow up to 1,200 ha of cropland. Approximately, 30 farmers will participate in this program, including two farmers organizations and ten individual farmers.

The Food Security and Agricultural Assistance for IDPs and Host Families subgrant is implemented by the International Rescue Committee (IRC) in collaboration with the Agricultural Cooperative Development International (ACDI). Its purpose is to provide agricultural extension services and material assistance to persons displaced due to recent internal conflicts and their host families in western Georgia. IRC will provide training and technical assistance to 100 farmers through four small (ca. 1 ha) demonstration plots in western Georgia.

Findings and Conclusions

The proposed use of pesticides and fertilizers under the TVG and IRC subgrants will be restricted to agricultural lands. As far as it could be determined, there are no water bodies, protected areas, wildlife sanctuaries, reserves, or undisturbed communities within or near the subgrant implementation sites. Since during the past four years, overall pesticide use in Georgia has been negligible, at present there are no significant environmental or health problems associated with past pesticide use in the subgrant implementation areas.

Most pesticides and fertilizers requested under the Save the Children program will be used by TVG to grow approximately 1,200 ha of wheat. Wheat and other field crops grown in Georgia are subject to severe competition from several weed species, such as morning glory, thisles, wild radish, pigweed, lambsquarter, Johnson grass, wild oats, and quack grass. IRC's use of agrochemicals will be negligible, as its intervention will be limited to four demonstration plots of about 1 ha each.

With the collapse of the Soviet Union, the state-controlled, centralized agrochemical production and distribution system ceased to function, and pesticides and fertilizers have been scarce in Georgia during the past four years. Georgian farmers are relying mainly on manure to supply nutrients to the soil and routinely employ crop rotation, sanitation, and other cultural crop management practices. The almost total absence of pesticide use during the past four years has undoubtedly led to the proliferation of natural enemies of insect pests and the enhancement of the natural biological control component in practically all agroecosystems.

The herbicides needed by TVG and one of the insecticides that may be requested by CARE are "general use" pesticides, which are currently registered in the U.S. by EPA for similar uses. These products have been selected on the basis of their known effectiveness for their intended uses, their Georgia and U.S. registration status, and their relatively low risk to humans and the environment. None of these pesticides, if used according to label instructions and observing safe pesticide management procedures, should pose a significant risk to applicators, farmers, or nontarget organisms.

The fertilizer to be procured by TVG, ammonium nitrate, will be applied to fields that have been depleted of nitrogen over the past several years as a consequence of fertilizer unavailability to ensure acceptable wheat yields during the next planting season. Soil will be tested in all collaborating farms, and fertilizers will be applied only as needed.

Alternative techniques, such as crop rotation with alfalfa, are being actively pursued by some experimental stations and interested groups in Georgia. A three year rotation cycle with a nitrogen-fixing legume, like alfalfa, will provide the necessary nitrogen to the soil and eliminate the need to apply inorganic fertilizers. Although rotation with legume crops is highly desirable as a natural means to incorporate nitrogen into the soil, the time needed to build up the necessary nitrogen levels makes this technique impractical for wheat seed production during the next planting cycle.

An alternative to the application of herbicides is the mechanical removal of weeds. Mechanical weed control, however, must be repeated periodically, as weeds continue to grow along with the crops during the entire season. Furthermore, it is labor-intensive, and while desirable in small gardens, it is cost-ineffective when practiced in large plots.

Although Georgia has comprehensive regulations that apply to the use of agrochemicals in agriculture, in practice there is little effective governmental control in this area. For this reason, TVG will need to assume full responsibility for all aspects of the handling, distribution, storage, use, and disposal of the two herbicides and the fertilizer requested. This same general directive should apply to CARE, were it to procure pesticides with USAID funds in the near future.

Recommendations

- **Pesticides**: The herbicides 2,4-D and dicamba are recommended for use in the production of winter wheat under the TVG and IRC subgrants. Likewise, Novodor is also recommended as highly suitable for the control of the Colorado potato beetle in Georgia. On the other hand, Decis (Deltamethrin) is not registered by EPA, and its procurement with USAID funds is not recommended. A list of alternative products is provided.

- **Training**: Extensionists and key farmers participating in the TVG and IRC subgrants should receive basic training in weed/pesticide management within two months of EA approval (see section 3.11). The Weed Control Training Manual, produced by the Oregon State University, should be translated to Georgian as soon as possible and used as a training manual for the training workshops.

- **Pesticide and fertilizer storage**: TVG should assume full responsibility for all aspects of the distribution, storage, handling, use, and disposal of the herbicides and fertilizer requested. TVG should require that prior to delivery of the agrochemicals, each participating demonstrates that he/she has access to separate, appropriate storage facilities, as outlined in section 3.10.

- **Pesticide monitoring**: The TVG project manager, with the guidance of a U.S. weed/pesticide management specialist should track pesticide use practices, in order to detect and help correct, in a timely fashion, any potential safety or effectiveness problem that may arise. No pesticide applications will be allowed within 300 m from human habitations or water bodies, such as rivers, streams, lagoons, or ponds.

- **Pesticide use safety equipment and procedures**: Safety equipment, such as goggles, and rubber aprons, gloves, and boots, should be made available by TVG and IRC to participating farmers and extensionists (see section 3.4). Each participating farm should have running water and soap readily available in case of accidental exposure. Technical assistance and training for farmers under this project should include pesticide management and safety, including demonstration of pesticide use safety practices, safety equipment, first aid procedures, and appropriate application techniques.

- **Fertilizer**: TVG should require that soil from winter wheat production plots under its subgrant be tested to assess actual fertilization needs in each participating farm. TVG should also encourage crop rotation with alfalfa or other suitable legume as a long term, sustainable alternative to inorganic fertilizers.

- **Technical assistance**: A qualified U.S. based pest/pesticide management specialist, with expertise in weed management and holding a valid U.S. pesticide application license should be contracted, on a short-term basis, to assist with training (section

3.11)), screening and approval of pesticide storage facilities (section 3.10), and pesticide monitoring activities (section 3.12). Additional suggested tasks are outlined in section 3.3.

- **Pesticide management/CARE**: CARE must assume responsibility for the storage, handling, use, and disposal of pesticides procured with USAID funding. All pesticide application activities for the control of the Colorado potato beetle should be supervised by a qualified agronomist or crop protection specialist with expertise in pest/pesticide management. CARE should refer to section 3.6 for special instructions concerning the effectiveness and use of Novodor.

2.0 Background

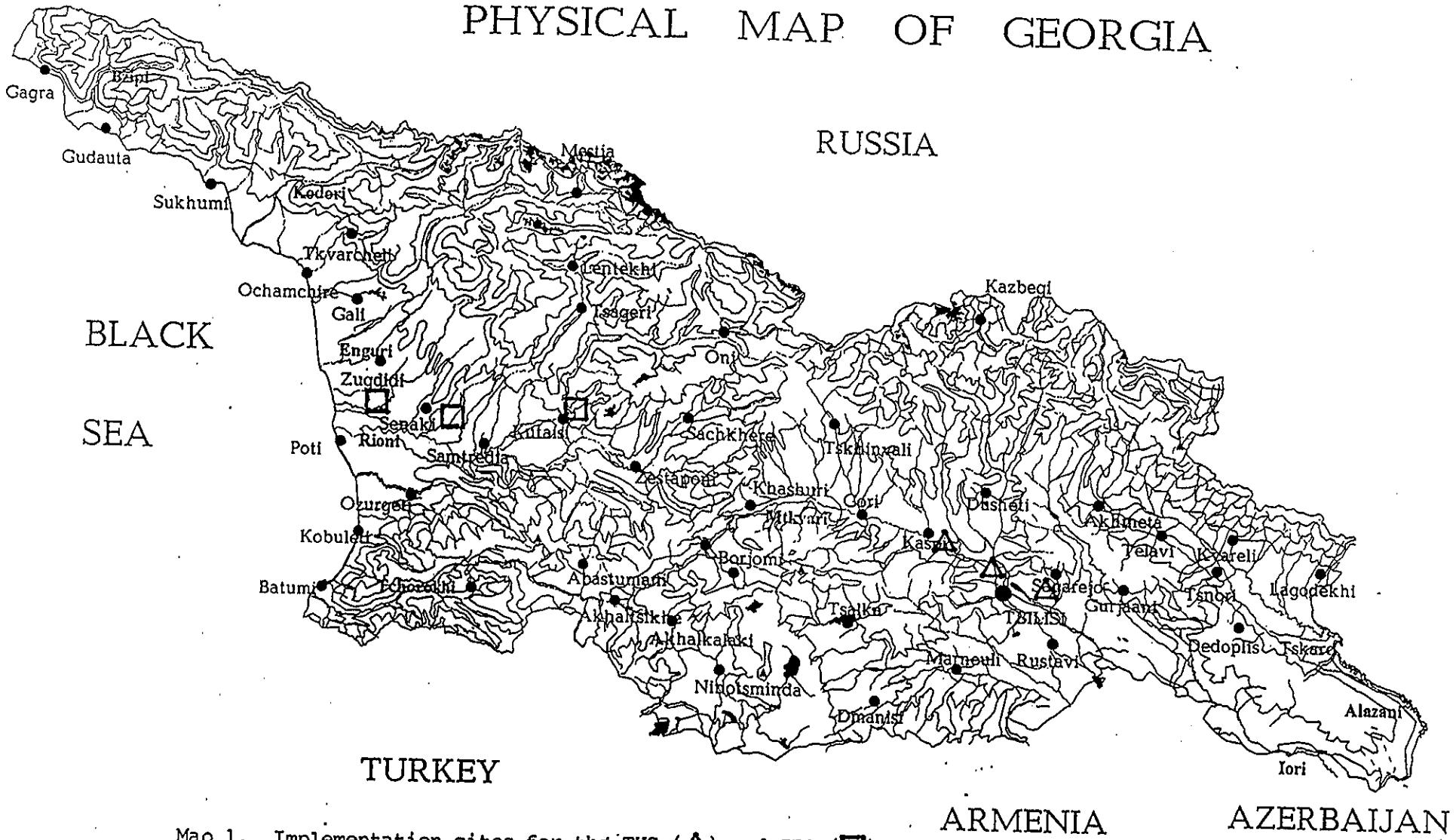
2.1 Internally Displaced Persons (IDPs) in Western Georgia

As a direct consequence of the civil war originating from the Ossetia and Abkhazia regions efforts to secede from Georgia, countless people, most of them ethnic Georgians, have been forced to flee their homes. Most of them are now living a precarious existence in portions of western Georgia as refugees, some of them with host resident families. The purpose of the Food Security and Agricultural Assistance for IDPs and Host Families subgrant is thus to provide agricultural extension services and material assistance to Internally Displaced Persons (IDPs) and host families in western Georgia. This subgrant is implemented by the International Rescue Committee (IRC) in collaboration with Agricultural Cooperative Development International (ACDI).

IRC is in the process of selecting four demonstration farms in the vicinity of Kutaisi, Abasha, and Khobi, western Georgia (Map 1), where 100 progressive farmers will be trained in activities such as crop production, poultry production, bee keeping, composting, food processing, agroforestry, and seed distribution. Key participating farmers will be expected, in turn, to share newly acquired information and skills with fellow farmers, thus expanding the technology transfer process in a multiplicative fashion. At each farm, a qualified extensionist will be responsible for all the planned training and extension activities and will assist with crop management decisions. Specialized technical assistance in selected areas will be provided by U.S. consultants. To participate in this program, interested farmers must own a minimum of 0.25 ha of land.

2.2 Technical and Commodity Assistance Program

With the collapse of communism and the emergence of internal conflicts, agricultural production in Georgia has declined, and the state-operated seed distribution system has became obsolete. For the past three years there has been a serious shortage of agriculture inputs, including seeds, agrochemicals, fuel, and spare parts for farm equipment. There is an acute need to help Georgian agriculture recover and to find suitable alternative seed production and distribution mechanisms. The purpose of the Technical and Commodity



Map 1. Implementation sites for the TVG (△) and IRC (□) subgrants

Assistance to the Republic of Georgia subgrant is to increase local private sector capacity to produce and market seed and food commodities. Under this subgrant, approximately 200-250 tons of fertilizers (ammonium nitrate), 700 gallons or 5,700 lbs of fertilizers (2,4-D and dicamba), and 150 tons of wheat seed will be procured in the U.S., Turkey, and Ukraine and distributed to participating farmers to sow up to 1,200 ha of cropland. TVG Subgrant implementation sites are located in the Kaspi, Mtskheta and Tetri Tskaro areas, and east of Tbilisi, eastern Georgia (Map 1).

Approximately, 30 farmers will participate in this program, including two farmers organizations and ten individual farmers. This subgrant is implemented by the Tri Valley Growers (TVG) in collaboration with ACDI.

2.3 The Colorado Potato Beetle in Georgia

As in most other potato growing regions in Former Soviet Union republics, potato production in Georgia is chronically affected by pests such as the Colorado potato beetle, aphid-transmitted viral infections, potato late blight, and various species of weeds. Without an effective certified potato production system in place, the quality of potato seeds has gradually deteriorated during the past four years. The Colorado potato beetle, by feeding on the crop's foliage during both larval and adult stages, can be especially injurious to potatoes and other solanaceous (tomatoes, peppers) crops. As this insect does not have effective natural enemies in this region, the lack of access to suitable commercial biological control agents and organosynthetic insecticides during the past four years have further hindered the farmers' ability to manage potato beetle infestations. In the near future, CARE may seek USAID assistance with the procurement of insecticides for control of this pest in some of its project implementation areas.

2.4 Crop Protection and Pesticide use History in Project Implementation Areas

Wheat and other field crops grown in Georgia are subject to competition from several major weed species. Among the more common and hard to control of these are: morning glory (*Convolvulus arvensis*), thisles (*Circium* spp.), wild radish (*Raphanus sativa*), pigweed (*Amaranthus* spp.), lambsquarter (*Chenopodium* spp.), Johnson grass, (*Sorghum halepense*), wild oats (*Avena fatua*), and quack grass (*Agropyrom repens*). It is common to find wheat, corn, and sunflower fields severely infested with these and other weed species. A list of the more common insect pests of wheat in Georgia is included in Appendix II.

Potato pests in Georgia include curly top virus, potato late blight (*Phythopthora infestans*), Colorado potato beetle (*Leptinotarsa decemlineata*), aphids (vectors of viral diseases), potato tuberworm (*Pthorimaea operculella*), minor soil pests such as cutworms and wireworms, and several weed species. Post-harvest diseases include bacterial soft rot (*Erwinia solanivora*) and black scurf (*Rhizoctonia solani*). In the past, control of potato beetle and late blight has usually required 2-3 pesticide applications, each.

In addition to various weed species, the more common pests of corn in Georgia include the European corn borer (*Ostrina nubilalis*), two species of corn earworm (*Heliothis armigera* and *H. obsoleta*), the corn leaf aphid (*Rhopalosiphum maidis*), mole crickets (*Gryllotalpa gryllotalpa)*, cutworms (Noctuidae) and wireworms (Elateridae). This pest species composition is virtually the same as that reported in neighboring Krasnodar, Russia and in Ukraine.

With the break-up of the Soviet Union, the state-controlled, centralized agrochemical production and distribution system ceased to function. As a consequence, pesticides and fertilizers have been for the most part unavailable during the past four years. At present, Georgian farmers seldom apply pesticides, and most rely on manure to supply nutrients to the soil, as agrochemicals are either unavailable or prohibitively expensive.

Although it is generally accepted that the lack of fertilizers and pesticides has adversely affected crop yield during the past four years, there is little reliable crop-specific data relating lack of fertilizers or specific pesticides to yield loss values. For instance, insect-related crop losses of up to 40-45% on grapes are reported by a well-known local crop protection specialist. A decrease in yield of 0.3-0.4 metric tons/ha is likewise reported for winter wheat in the absence of herbicides. A 66% crop loss and a severe reduction in tuber quality is also being reported for Georgia's 1994 potato production, much of this due to CPB attacks. There are also reports of fruit trees being lost to fungal diseases, some of which were observed during the EA site visits.

During the Soviet era, pesticides in Georgia were often overused on perennial crops such as orchards, vineyards, and tea plantations, partially because agrochemicals were subsidized and technical assistance was rather limited. Implementation of IPM has not been a priority under the former system, while the adverse environmental and health effects of excessive pesticide use have not been a main concern of decision-makers.

Under the Soviet Union system, farmers depended entirely on state-controlled agrochemical distribution systems. Farmers had to use those products that were provided by the state, which often changed from year to year. Also, under the former Soviet system, "extensionists" communicated instructions and information only to the farm managers and farm extensionists, and had little contact with individual farmers. Thus farmers were out of the information loop and had little opportunity to accumulate farm management information from year to year, as traditional farmers do in the west. Most "farmers" were really workers who became specialized in performing particular tasks, and few had the opportunity to look at the entire farming operation as a whole. This is one of the reasons why farm management and crop production skills are lacking and why ACDI, TVG, and IRC are helping to build up such capacity. Because under the Soviet system farmers dealt only with isolated elements of crop management, many never learned to identify insects and weeds, diagnose plant diseases, or select, handle, and apply safely and effectively pesticides or fertilizers.

2.5 Purpose of the Environmental Assessment

Activities to be supported by the combined subgrants will include technical assistance and training in areas such as: farm management; crop production, including wheat and vegetables; grain storage and distribution; poultry production; bee keeping; food processing; agroforestry; and composting. Selected commodity assistance in the form of seeds, fertilizers, and pesticides will also be provided. One subgrant will target poor, displaced families living in project sites in order to diversify their economic base. The other will provide an alternative to the obsolete state-run seed distribution program.

The U.S. Foreign Assistance Act (FAA) requires that environmental concerns are integrated into the USAID decision making process. The purpose of the USAID environmental review process is, accordingly, to assess the environmental consequences of USAID's actions. USAID policy requires that the potential environmental impacts of certain proposed actions are identified before the actions are implemented and that appropriate environmental safeguards are adopted to prevent or minimize such impacts. The specific requirements for the review process are outlined in the USAID Environmental Procedures, 22 CFR Part 216. Because the Project will include assistance for the procurement and use of pesticides and fertilizers, an Environmental Assessment (EA) of the proposed uses must be prepared, and the EA must be then reviewed and approved by the Bureau's Environmental Officer before the proposed actions are taken.

3.0 Pesticide Use Assessment: Findings and Conclusions

3.1 U.S. EPA registration status of the requested pesticides

In the U.S., a pesticide is defined as a chemical, physical, or biological agent designed to control a pest organism. A pest is defined as an organism that is injurious to humans, their crops, animals, or possessions. Organisms that may acquire pest status include: weeds, insects, mites, fungi, bacteria, viruses, nematodes, mollusks, and some species of birds and rodents. One way of classifying pesticides is in function of the kind of organisms controlled, i.e. herbicides, insecticides, acaricides, fungicides, bactericides, nematicides, molluscicides, and rodenticides. In this EA, the term pesticide will be used in a manner consistent with the above definition.

The U.S. Environmental Protection Agency (EPA) classifies pesticides as either unclassified (also known as general use pesticides) or restricted use pesticides (RUPs), depending on the potential health and/or environmental risk associated with their use. The toxicological, residue, and environmental fate data needed by EPA to assess relative risk and to reach such decision is provided by manufacturers seeking to register their products. It takes several years of research to generate the information required by EPA.

Unclassified or general use pesticides are considered to pose minimal risk to man and nontarget animals and can be purchased and applied by the general public. All the pesticides

commonly sold for home and garden use in the U.S. are in this category.

On the other hand, in the U.S. restricted use pesticides may be purchased and applied only by trained, licensed applicators or by persons under their direct supervision. Many RUPs have high mammalian toxicities and their inappropriate use could result in increased risk for humans, due to accidental or labor-related exposure. Inappropriate use of other RUPs may have harmful effects on nontarget terrestrial and/or aquatic nontarget organisms. In general, most insecticides, acaricides, and nematicides (especially organophosphorus and carbamate products) tend to be classified as RUPs, whereas most fungicides and herbicides fall into the general use category.

Pesticides may also be classified as RUPs if strongly suspected of causing delayed, chronic effects in humans, such as cancer (carcinogenesis), tumor formation (oncogenesis), mutations (mutagenesis), fetal deformations (teratogenesis), sterility, hypersensitivity, delayed neurotoxicity, and respiratory ailments. Pesticides suspected of having the potential to cause long-term adverse effects to humans or of being especially hazardous to nontarget organisms are also included in EPA's Special Review category. The Special Review process, which may take several years to complete, provides manufacturers with the opportunity to present evidence supporting claims to the contrary. Once a special review is completed, the registration status of a pesticide may remain unchanged, it may undergo significant changes in its approved uses, or it may be partially or totally cancelled.

Cancelled and suspended pesticides are those which are no longer registered by EPA. Their application, in any form, is illegal in the U.S., except for specifically designed purposes in some cases. For example, most organochlorine pesticides (including the so called "dirty dozen") are in this category.

Pesticide toxicity is expressed in LD_{50} values. LD_{50} is defined as the average lethal dose, expressed in mg of active material per kilogram of body weight (mg/kg) that will kill 50% of test animals, usually rats. LD_{50} values are established on the basis of acute oral, dermal, or inhalation toxicities. EPA's pesticide toxicity categories are shown in Table 1.

To achieve its intended objectives, TVG will procure and distribute the herbicides dicamba and 2,4-D for use in the production of winter wheat. Both herbicides are "general use" pesticides and are currently registered in the U.S. by EPA for the same or similar uses as those proposed (see Table 2). These herbicides are to be applied at the rate of about 1.5 lbs or 1.5 pints/acre. The herbicide bromoxynil (Toxicity: Oral LD_{50} = 260 mg/kg. Dermal LD_{50} > 2,000. Toxicity class: II), initially recommended for use under the subgrants, is rather unsuitable for the proposed uses (see sections 3.2 and 3.6).

TVG will also procure and distribute to beneficiary farmers 200-250 tons of fertilizers, mainly ammonium nitrate. EPA does not register fertilizers, and their availability and use is not regulated in the U.S. in the same manner as pesticides are.

Table 1. Criteria used by EPA to establish pesticide toxicity categories

Hazard indicators	Category I:	Category II:	Category III:	Category IV:
Oral LD_{50}	≤50	50-500	500-5000	>5000
Inhalation LD_{50} (mg/liter)	≤0.2	0.2-2	2-20	>20
Dermal LD_{50}	≤200	200-2000	2000-20000	>20000
Eye effects	Corrosive, corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours
EPA signal word	"DANGER"	"WARNING"	"CAUTION"	"CAUTION"

Table 2. Pesticides recommended for use in the TVG subgrant and for Colorado potato beetle control by CARE

Trade/Common name	Toxicity and EPA classification status	Action/Approved uses	Environmental and health hazards
2,4-D	Oral LD_{50} = 700 mg/kg Dermal LD_{50} = 200 mg/kg Toxicity class III Signal word: Caution EPA registration category: general use pesticide EPA tolerances on wheat: 0.5 ppm	Herbicide For postemergent control of a wide range of broadleaf weeds.	Protective clothing must include rubber gloves and apron, goggles, long pants, and long-sleeved shirt. Highly toxic to birds and bees. Nontoxic to fish.
Dicamba	Oral LD_{50} = 2629 mg/kg Dermal LD_{50} >2000 mg/kg Toxicity class II Signal word: warning EPA registration category: general use pesticide EPA tolerances on wheat: 0.5 ppm	Herbicide For postemergent control of annual and perennial broadleaf weeds.	Eye irritant: safety equipment must include goggles. Slightly toxic to fish. Nontoxic to bees.
Novodor (*Bacillus thuringiensis* var *tenebrionis*)	Toxicity class III Signal word: Caution EPA tolerances: exempt on row agricultural commodities	Biological insecticide For control of the Colorado potato beetle on potatoes, tomatoes, eggplant.	Nontoxic to nontarget organisms (fish, birds, mammals, bees).

Of the two insecticides that may be requested for Colorado potato beetle (CPB) control by CARE, the biological insecticide Novodor (Table 2) is registered without restriction in the U.S. for the same use. On the other hand, the pyrethroid insecticide Decis (deltamethrin) (Toxicity: Oral LD_{50} = 128.5 mg/kg. Dermal LD_{50} > 2,000 mg/kg. Toxicity class: II.) is not yet registered for use in the U.S. by EPA and, on this basis, it is not recommended for procurement/use by CARE at this time. Several alternative insecticides registered by EPA for use, without restriction, on potatoes are listed in Table 3. However, a great deal of caution must be exercised when applying these or any other insecticides to avoid creating a dependency on their use and the increasing risk of resistance build-up over time. In the U.S. for instance, the CPB has developed resistance against most insecticides.

Table 3. Additional insecticides registered for use on potatoes in the U.S.

Common/Trade Names INSECTICIDES	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LD_{50} (mg/l)	Toxicity Class/ Signal Word
Carbaryl (Sevin)	>5000	>2000	6.08	II,III, Warning, Caution
Diazinon	300-400	3600		II, III - Caution, Warning
Dimethoate	235			II, Warning
Malathion	5500	>2000	>5.2	III, Caution
Methoxychlor	6000			IV, Caution
Phosmet (Imidan)	147-316	>4640		II, Warning

3.2 Basis for selection of the requested pesticides and fertilizers

The herbicides requested for use under the TVG and IRC subproposals have been selected on the basis of their known effectiveness for controlling the more serious weeds affecting wheat production in Georgia (see section 3.6), as well as their relatively low mammalian toxicities and risk to humans (see sections 3.1). The choice of products needed to provide an acceptable level of control of target weeds, within a sustainable pest management context, is based on on-site observation and assessment of current crop management practices and needs in the subgrant implementation sites by qualified Georgian and U.S. crop protection specialists. See section 3.6 for special instructions when using Novodor for control of the CPB.

The fertilizer to be procured, ammonium nitrate, will be applied to selected plots, which have been depleted of nitrogen over the past several years as a consequence of the current unavailability or high prices of fertilizers in the local market. Its use is necessary to ensure acceptable wheat yields during the next planting season. Soil will be tested in on all collaborating farms, and fertilizers will be applied only as needed and in the amounts required. At this time, no need for the application of phosphorous-containing fertilizers is anticipated during the next planting cycle.

3.3 Extent to which the requested pesticide use is part of an integrated pest management program

As presently designed, the TVG and IRC subgrant activities are not part of an integrated pest management (IPM) program, although the possibility of implementing a modest training in IPM is being considered by IRC during a future phase. As in other former Soviet Union republics, there is no tradition of IPM implementation in Georgia. On the other hand, farmers regularly practice crop rotation, sanitation, and other cultural crop management practices that have the effect of reducing pest populations. The almost total absence of pesticide use during the past four years in Georgia has undoubtedly led to the proliferation of the natural enemies (predators and parasitoids) of insect pests in practically all agroecosystems. Ironically, because of the pesticide scarcity, IPM's aim when applied to crops that are being oversprayed, which to reduce pesticide applications as much as possible, has already been fortuitously achieved in Georgia.

The support of a U.S. based pest/pesticide management specialist, with expertise in weed management, is needed to provide the know-how needed to further strengthen the subgrants' crop and environmental protection objectives, as identified in this EA (see also sections 3.10 and 3.11). Essential tasks that should be performed by this individual include: a) providing guidance and assisting with the design and presentation of a weed and pesticide management workshop for participating farmers and extensionists; b) providing technical assistance in weed and pesticide management, as needed; c) setting up weed management demonstration plots for farmers; d) with the assistance of subproject extensionists, monitoring weed management and pesticide use practices; e) acquiring and maintaining a small, practical pest/pesticide management reference library for the project; and f) establishing and maintaining professional contacts with individuals and institutions involved in pest/pesticide management in Georgia.

3.4 Proposed methods of application, including availability of appropriate application and safety equipment

In the TVG and IRC assisted farms, herbicides will be applied by both tractor-mounted boom sprayers, as well by backpack sprayers. After years of pesticides and equipment shortage, spray equipment is old, in poor condition and in dire need of maintenance and repair. Nozzles, in particular, will need to be replaced yearly. The need to deliver the correct amounts of herbicides is critical to avoid damaging the crop and will need special TVG attention. Since all the pesticide spray equipment used in Georgia came originally from the former Soviet Union, nozzles and other spare parts must be imported from Russia as well, and this can be a very slow process at present. As a temporary alternative, while replacement spray nozzles are being shipped from Russia, the best of them should be selected and, if necessary, rotated from farm to farm until the new nozzles arrive. Nozzle selection can be done by spraying water through each nozzle for a fixed period of time into a jar, taking the average (arithmetic mean) output from several nozzles, and discarding all those that show a +/- 10% variation from the average, i.e. those that deviate

from it either way by 10% or more.

Safety equipment, such as goggles, and rubber aprons, gloves, and boots, will be made available by TVG and IRC to participating farmers and extensionist. At a minimum, farmers applying class II and III pesticides (see Table 1) should use appropriate clothing and footwear. Technical assistance and training for farmers under this project should include pesticide management and safety, including demonstration of pesticide use safety practices, safety equipment, and appropriate application techniques. Even those farmers and extensionists who have had previous pesticide application experience will need to be reacquainted with appropriate pesticide management procedures.

In addition, each participating farmer should have access to running water and soap in case of accidental pesticide exposure. Each participating farmer and extensionist should be also informed as to first aid procedures and what to do in case of accidental spills or exposure to the herbicides being used. This information should be obtained directly from the products' labels.

3.5 Acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards

None of the pesticides proposed for use under this project, if used according to label instructions and within the context of a sound pesticide management approach, should pose a significant risk to applicators, farmers, or nontarget organisms. On the other hand, pesticides are inherently toxic substances and can be potentially hazardous to humans and the environment, if used improperly.

For instance, accidental spills, usually associated with pesticide mixing and loading areas, can have localized but severe environmental impacts if not dealt with rapidly and adequately. Pesticide drift, which is intensified by spraying on windy days, can be harmful to nontarget crops, natural vegetation, and nontarget organisms in surrounding areas. Spraying against the wind can result in the intoxication of the applicator.

Rainfall and/or irrigation in association with intense and widespread pesticide and fertilizer use can lead to ground water contamination. Water runoff resulting from heavy rainfall can transport pesticides and/or their metabolites to distant places located downstream. This can result in the contamination of distant water bodies such as lakes, reservoirs, lagoons, ponds, and estuaries.

Beneficial arthropods, such as pollinators and the natural enemies of insect pests, are especially vulnerable to wide-spectrum insecticides. Excessive insecticide use will inevitably reduce or eliminate natural enemy populations, thus contributing to unchecked pest population increases and even to secondary pest outbreaks once the initial pesticide effects have ceased. The development of pesticide resistance in target pest populations is another

undesirable consequence of pesticide overuse. Although no insecticide use is anticipated in TVG or IRC assisted plots at this time, the need for such products may arise in the future, and farmers must be reminded of these risks. The message in this paragraph, however, does apply to the potential use by CARE of organosynthetic insecticides to control the Colorado potato beetle.

To minimize potential risks associated with pesticide use, subgrant extensionists and key farmers need to encourage and promote the adoption of rational pesticide use practices in project implementation sites. Beneficiary farmers should be required to apply chemicals only when necessary, on the basis of guidelines provided by TVG's crop protection adviser, and following the user instructions and safety recommendations specified in the manufacturer's label. In addition, no herbicides should be applied within 300 m from human habitations or water bodies, such as rivers, streams, lagoons, or ponds. To achieve an acceptable level of expertise in weed/pesticide management, extensionists and participating farmers will need to be trained in this area, as specified in section 3.11 of this EA.

There are also potential environmental risks associated with excessive fertilizer use. Nitrates and phosphates, byproducts of fertilizer breakdown, may be carried in runoff water during periods of abundant rainfall or may leach into the ground water, sometimes reaching the deeper aquifers. When these compounds reach water bodies, such as small lakes, lagoons, and ponds, an accelerated eutrophication process may follow. This in turn may favor the proliferation of certain green and blue-green algae species, while causing the death of the resident aquatic life. In extreme cases, bottle-fed infants can be at some risk when nitrate values exceed 50 mg/l^{-1} as NO_3. Nitrates in water may be converted into nitrites in infants' stomachs and react with blood to form methemoglobin, a molecule implicated in causing cyanosis or blue baby syndrome. A few such cases have been documented in countries having a history of intensive fertilizer use.

Most Georgian cropland has not been treated with fertilizers over the past four years, due to the generalized unavailability of agrochemicals. Inorganic fertilizers, especially nitrogenous compounds, are necessary at this time to ensure acceptable wheat seed production levels. The small scale and temporary duration of the proposed activity will ensure that the proposed fertilizer use will not have any adverse impact on the affected environment. Furthermore, prior to applying fertilizers, participating farmers will analyze the soil in subgrant fields to determine units of ammonium nitrate needed. Because phosphate fertilizers were especially subsidized and freely applied in the past, TVG has determined that there will not be any need for additional applications at this time.

Alternative techniques, such as crop rotation with alfalfa, are being actively pursued by some experimental stations and interested groups in Georgia. It is well known fact that a 3-5 year rotation cycle with alfalfa or another legume with high nitrogen-fixing properties will provide all the nitrogen needed for a field crop.

3.6 Effectiveness of the requested pesticides for the proposed use

The herbicides 2,4-D and dicamba are effective against perennial broadleaf plants, such as morning glory. These compound resemble plant growth hormones (auxins) and act by interfering with plants' normal hormonal growth regulation mechanism. These chemicals should provide the desirable control of most weeds affecting winter wheat and other project target crops. A single application is needed to permanently destroy the target plant. In contrast, Bromoxynil is not too effective against the morning glory, as it affects only the above-ground portion of the plant, leaving the root undamaged. Thus, the plants continue to grow and eventually require additional herbicide applications.

The bioinsecticide Novodor is a commercial preparation of the *tenebrionis* subspecies of the bacterium *Bacillus thuringiensis* (Bt), which selectively infects small Colorado potato beetle (CPL) larvae when ingested. Bt produces toxic insecticidal crystal proteins that damage the insect's gut, which in turn facilitates infection by Bt and other microorganisms. Infected larvae cease to feed and die. Novodor not only is highly effective against young CPL larvae, but it is also completely harmless to man and nontarget organisms.

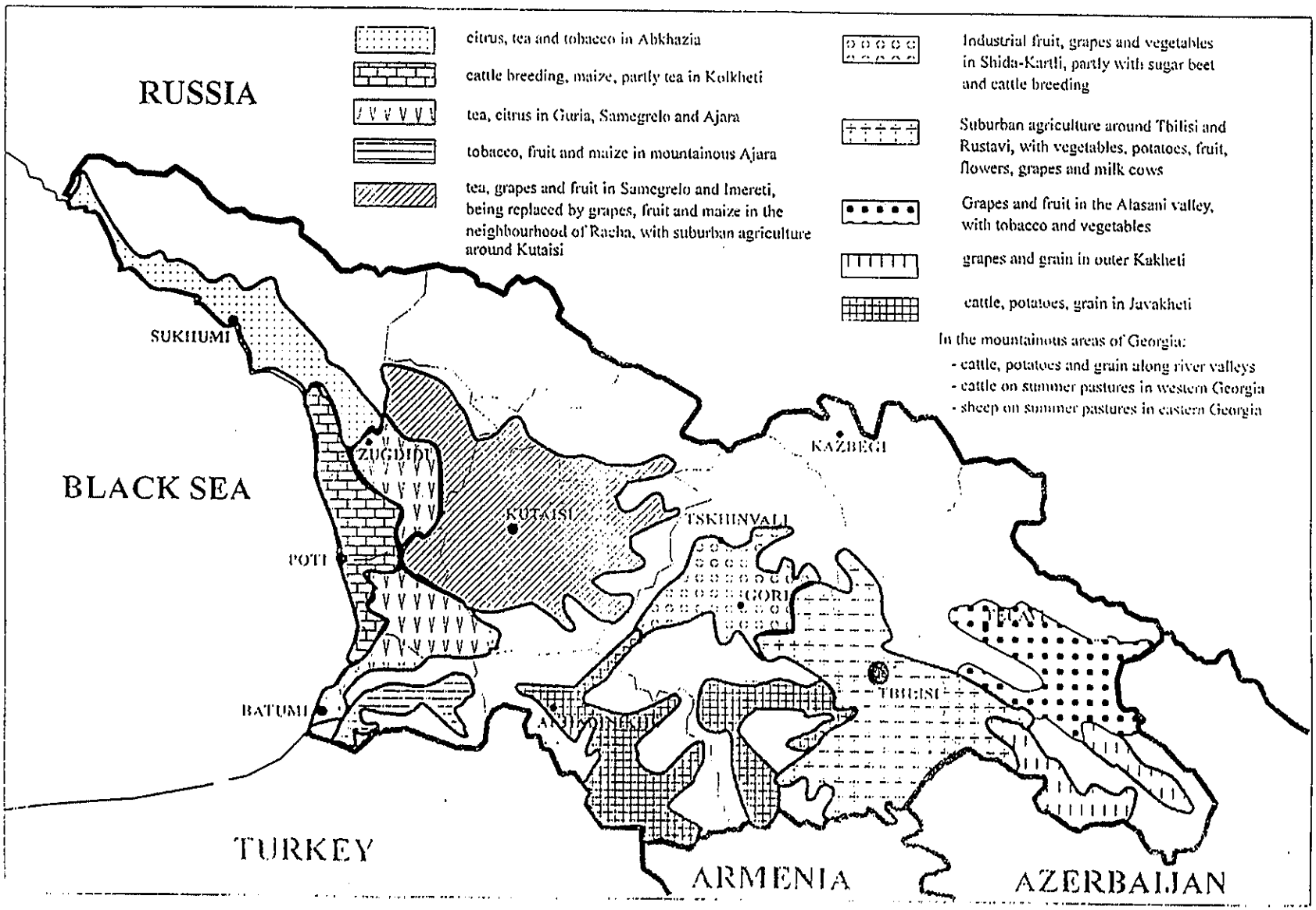
A word of caution when using Novodor is appropriate at this point. CARE must be made aware that this product is **effective only against very small (less than 4-5 days old) CPB larvae. It will not affect older larvae or adults**. This means that, to be effective, Novodor must be timed to coincide with the period when eggs are being laid and larvae are hatching. This means close monitoring of CPB activities and applying the moderately expensive Novodor every 4-7 days and up to 6 times during its peak oviposition period. In addition, application of an organosynthetic insecticide will probably be necessary to control older larvae and adults.

3.7 Compatibility of the proposed pesticide with target and nontarget ecosystems

The proposed use of pesticides under the TVG and IRC subgrants will be restricted to agricultural lands. There are approximately 800,00 ha of arable land in Georgia (Map 2), of which about 320,000 are in perennial crops, including citrus and other fruit trees, vineyards, and vast tea plantations. Another 300,000 ha are in field crops, such as wheat, maize, soybeans, beans (often grown in association with corn), sunflower, and alfalfa. There are also about 25,000 ha of potatoes and some 40,000 ha of other garden vegetables, including cabbage, tomatoes, cucumbers, eggplant, red beets, and sweet peppers.

As far as it could be determined, there are no water bodies, protected areas, wildlife sanctuaries, reserves, or undisturbed communities within or near the subgrant implementation sites. Since during the past four years, overall pesticide use in Georgia has been negligible, at present there are no significant environmental or health problems associated with past pesticide use in the subgrant implementation areas.

Map 2. Principial Location of Crops and Livestock in Georgia



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3.8 Conditions under which the pesticides are to be used, including climate, flora, fauna, geography, hydrology, and soils.

Much of Georgia is mountainous, and about half of the land supports extensive deciduous and coniferous forests and grasslands. There are about 2 million ha of state forest land, of which 43% are on slopes exceeding 30°. The soil erosion process in Georgia has intensified recently as a result of farming on hillsides with slopes that exceed 20-30°. In addition, the recent internal strife in portions of Georgia have contributed to the acceleration of forest utilization for fuelwood by the local population. Agricultural land occupies almost half of Georgia's territory. All TVG and IRC subgrant intervention sites are located on mostly flat, well-drained, valley floor agricultural land areas, and their proposed activities should not contribute to soil erosion.

3.9 Availability and effectiveness of other pesticides or nonchemical control methods

An alternative to the application of herbicides is the mechanical removal of weeds. With little access to herbicides, mechanical weed control is widely practiced in Georgia at present. A drawback of mechanical weed control is that it must be repeated periodically, as weeds continue to grow along with the crops during the entire cycle. Hand weeding, using hoes, is also labor intensive, and while desirable in small gardens, it is cost-ineffective when attempted in large plots.

Although there are many herbicides in the market, relatively few meet the special conditions required in the TVG plots, which include: effectiveness in controlling the morning glory while not damaging the wheat plant, registration by EPA for the same or similar uses and without restriction (i.e. not an RUP), being registered for use in Georgia, and not being too expensive.

A wide variety of crop management practices and biological control techniques exist which, if properly applied, can reduce dependance on chemical pest control. These techniques take advantage of natural mortality factors acting on pest organisms. Their effectiveness varies with the crop, pest complex, degree of acceptance and adoption by farmers, and crop production techniques and marketing strategies.

For instance, crop rotation can be used to reduce the populations of soil pests, especially those which are crop-specific, including plant pathogens, nematodes, and insects. In addition, a three year rotation cycle with a nitrogen-fixing legume, like alfalfa, will provide the necessary nitrogen to the soil and eliminate the need to apply inorganic fertilizers. Alfalfa grown in the same plot over a five year period will add about 180 units of nitrogen to the soil.

The Colorado potato beetle (CPB), which feeds on potato foliage both in the adult and larval stages, can be especially damaging to this crop. A subspecies of *Bacillus thuringiensis*, marketed as Novodor, specifically attacks newly hatched CPB larvae and

represents an ecologically-sound alternative to chemical control approaches. Using the recently developed seed potatoes that contain built-in CPB-specific plant pesticides may represent an second nonchemical control possibility in the future. These potato plants can produce the same toxic crystals (delta-endotoxin) produced by *B. thuringiensis* during sporulation, i.e. the "active ingredient" of Novodor. On March, 1995, EPA issued to Monsanto Co. a limited registration for the production of 8,186 acres of the plant pesticide-producing potato for seed (not food or feed) uses only. For further information on this promising technology, CARE may contact Dr. Judith Chambers (tel: 202/663-2598, fax: 202/663-2507, 663-2552).

Although not mentioned as a target pest in the CARE activities, the potato tuberworm is another pest that may be managed through the release of parasitic wasps, such as *Trichogramma* spp. and *Copidosoma* spp., that could be reared in local insectaries. The International Potato Center (CIP) in Peru has been developing and implementing biological control techniques for the tuberworm for several years.

3.10 Requesting country's ability to regulate or control the distribution, storage, use and disposal of the requested pesticides

Current pesticide regulations in Georgia, including the approved pesticides registry, is similar to those used throughout the former Soviet Union. For instance, Georgian pesticide tolerances follow closely the CODEX tolerances. Pesticide suppliers are required to provide a certificate of quality for its products, and labels of imported products must be in Russian. The color of a pesticide label indicates function: black labels for insecticides, red for herbicides, white for defoliators, green for fungicides, yellow for rodenticides, and blue for highly toxic pesticides. Pesticides are also classified according to toxicity and persistence.

Pesticide storage and supply facilities are subject to annual inspection. On this basis, operating permits are renewed yearly. Pesticide warehouses are required to be located 350 m from human habitations and must be outfitted with windows to allow for cross-wind circulation. On the other hand, there is a no effective state-regulated certification program for pesticide applicators in Georgia. Furthermore, during the present transition period, when many farms are being privatized, there is no effective way to regulate pesticide use, since the Soviet-era regulatory system was designed to deal with centralized pesticide distribution systems and collective farms. Although new pesticide use regulations are being developed in Georgia, for the time being, and unless otherwise indicated, the content of the old regulations still overlap significantly with Georgia's new Plant Protection Law, which covers those pesticide-related issues that in the U.S. fall under EPA jurisdiction.

As, in practice, there is little effective governmental control of pesticide use in Georgia at present, Tri Valley Growers will need to assume full responsibility for all aspects of the handling, distribution, storage, use, and disposal of the two herbicides and the fertilizer requested. Likewise, if CARE is to procure pesticides with USAID funds, it will also have to assume full responsibility for its storage, handling, use, and disposal. For

instance, TVG will need to require that prior to delivery of agrochemicals, each beneficiary farmer has access to pesticide and fertilizer storage facilities that meet the requirements outlined below.

TVG should communicate these requirements to each beneficiary farmer in advance of delivery to allow plenty of time for the necessary reconditioning of existing storage sheds. Prior to delivery of agrochemicals, TVG personnel should inspect the selected sheds for suitability. When a particular farmer is unable to produce a storage shed that meets the required standards when inspected, the agrochemicals should remain in the TVG warehouse and be delivered to that farmer on an as-needed basis, until the reconditioning of the storage shed is completed.

The storage of pesticides and fertilizers procured and used under the TVG and IRC subgrants should satisfy, at a minimum, the following conditions:

- All pesticides and fertilizers should be stored in enclosed, dry, and secure structures, protected from rainfall and extreme heat, and located away from food, feed, and water sources. Eating, smoking, or sleeping in the pesticide storage sheds should be prohibited. Georgian law requires that pesticide storage facilities be located at least 350 m from human habitations.

- Pesticide storage facilities should be clearly identified with a sign bearing the words: "DANGER - POISON" in Georgian or Russian and the universal skull and bones danger symbol. Storage areas should be kept locked when not in use.

- Pesticides should be stored in their original containers and should not be repackaged at any time. Each pesticide container should display a firmly attached label indicating, in Georgian or Russian, at a minimum the following information: product trade name, concentration of active ingredients, toxicity category, directions for use, safety precautions, special environmental concerns, re-entry statement if applicable, storage and disposal directions, and first aid and medical treatment indications.

- Empty pesticide containers should be destroyed to prevent reuse. The triple rinse system, followed by perforating and/or crushing the containers is a widely accepted practices. Once empty and rendered useless, the containers should be buried or transported to a sanitary field, as required by Georgian law.

- Instructions should include what to do in case of fire in the pesticide storage shed. For instance, local fire departments must know if water may or may not be used in a given situation. Such instructions should accompany each pesticide shipment. Appropriate fire-fighting equipment should be readily available, as recommended in the product's label (water, CO_2 extinguishers, etc.).

- Each collaborating farm should have access to a convenient wash area for pesticide

containers and spray equipment. This structure usually consists of a cement collecting area where the water used to rinse pesticide containers and spray equipment will be contained to facilitate its collection and re-use or disposal.

- It is highly desirable that posters explicitly describing and illustrating basic safety precautions and recognition of pesticide poisoning and first aid procedures are displayed in strategic areas, to assure maximum exposure. Such posters may be available from WHO, FAO, EPA, and all major agrochemical manufacturers.

TVG should consider bringing a qualified pesticide management consultant from the U.S. (see sections 3.3 and 3.11) to assist with the pesticide storage shed inspection activity. Ideally, the presentation of the pesticide/weed management workshops should coincide with the shed inspection task to make optimum use of the consultant.

3.11 Provisions made for the training of users and applicators

To ensure that Project extensionists and key farmers become familiar with the basic elements of appropriate pesticide and weed management practices, prior to the initiation of the crop production and protection activities, the following actions are recommended:

- Participating farmers and extensionists should attend a one week training workshop in weed and pesticide management. The workshop should be presented, by qualified Georgian or Russian-speaking trainers, to the 30 farmers collaborating with TVG and the four extensionist assigned to IRC's four demo farms. For workshop effectiveness and management and logistics considerations, it will be convenient to present two workshop sessions to a group of 17 participants, each. Emphasis will be on appropriate safe herbicide application techniques and correct use of fertilizers, as well as on the basics of IPM (see below). In addition, as it is anticipated that beneficiary farmers and extensionist will, in turn, help transfer the information acquired to other farmers so as to extend technology transfer in a multiplicative fashion, these individuals should be also trained in technology transfer and training techniques and approaches through the same farmer to farmer program.

- TVG should contract, on a short-term basis, the services of U.S. crop protection specialist, with expertise in weed and pesticide management (also refer to sections 3.3 and 3.10). It is highly desirable that this individual holds a valid U.S. pesticide application license. The TVG director in Georgia proposes to carry out this activity under TVG's Farmer to Farmer program, at no additional cost to the subgrant.

- The Weed Control Applicator Trainer Manual, produced by the Oregon State University, is well suited to satisfy the training needs identified in this EA and should be translated to Georgian as soon as possible for use as training manual in the recommended workshop.

The training workshop should cover, at a minimum, the following subjects:

- Introduction to pesticide toxicology, including the classification and characteristics of major pesticide groups, their mode of action, formulations, and toxicity, including the meaning of LD_{50} values
- Pesticide management and safety procedures, including safe pesticide handling, safety equipment, storage, mixing, application techniques and equipment, and disposal procedures
- Understanding and using the pesticide label
- Environmental and health consequences of pesticide misuse
- Common intoxication symptoms and first aid
- Principles and application of weed management
- Herbicide application procedures
- Calibration and maintenance of spray equipment
- Field identification of the more common weeds, insect pests and their natural enemies, and plant diseases associated with wheat and other target crops in the project implementation sites
- Introduction to the principles and applications of integrated pest management
- Introduction to crop nutritional requirements and fertilizer use

Training should be completed within two months after approval of this EA, and before the herbicides and fertilizers are distributed and applied.

3.12 Provisions made for monitoring the use and effectiveness of the pesticides

No formal mechanisms for monitoring pesticide use have been designed into this short-lived Subgrants. However, it is highly desirable that the TVG project manager, in collaboration with extensionists and key farmers, and with the guidance of the weed/pesticide management specialist (see 3.11), track pesticide use practices and trends, in order to detect and help correct, in a timely fashion, any potential problem that may arise. In the case of the winter wheat production activity, the pesticide application equipment and techniques need to be closely monitored.

4.0 Mitigation Plan and Recommendations

The recommendations outlined below are designed to ensure that the use of pesticides and fertilizers under the TVG subgrant satisfies the conditions set forth in USAID's Environmental Procedures, 22 CFR Part 216, and thus do not lead to adverse environmental or health effects in the implementation areas. TVG should also consult the annexes in the Tolisano et al. EA report (section 6.0) for additional useful information on pesticide safe use guidelines.

This section also addresses a possible pesticide request by CARE to control the Colorado potato beetle in Georgia.

- **Pesticide use, TVG subgrant:** The herbicides 2,4-D and dicamba (rather than bromoxynil) are recommended for procurement and use in the production of winter wheat under the TVG subgrant. After EA approval, future proposed changes or additions to the blend of products recommended in this section will be submitted as a proposed amendment to this EA to the Bureau's Environmental Officer for review and approval.

- **Pesticide use, CARE**: The biopesticide Novodor is highly suitable for the control of the Colorado potato beetle in Georgia, being registered for such use by EPA. On the other hand, Decis is not registered for use in the U.S. by EPA and is, therefore, not recommended for procurement with USAID funds. Some alternative insecticides are listed in Table 3.

- **Training**: Extensionists and key farmers participating in the TVG and IRC Subgrants will receive basic training in weed/pesticide management within two months of EA approval. The Weed Control Training Manual, produced by the Oregon State University, will be translated to Georgian as soon as possible and used as the standard training manual in the recommended workshops. Training requirements and suggestions are outlined in section 3.11.

- **Pesticide and fertilizer storage**: TVG will assume full responsibility for all aspects of the transport, handling, distribution, storage, use, and disposal of the two herbicides and the fertilizer requested. TVG must require that prior to delivery of the agrochemicals, each participating farmer shows that he/she has access to adequate pesticide and fertilizer storage facilities, which meet the requirements outlined in section 3.10.

- **Pesticide monitoring**: The TVG project manager, with the guidance of a U.S. weed/pesticide management specialist will track pesticide and fertilizer use practices, in order to detect and help correct, in a timely fashion, any potential environmental, health, or effectiveness problem that may arise. No pesticide application will be allowed within 300 m from human habitations or water bodies, such as rivers,

streams, lagoons, or ponds. The suitability of pesticide application equipment and techniques will be closely monitored.

- **Pesticide use safety equipment and procedures**: Safety equipment, including rubber aprons, gloves, and boots, as well as goggles, will be made available by TVG and IRC to participating farmers and extensionist. At a minimum, farmers applying class II and III pesticides (see Table 1) will use appropriate clothing and footwear. Each participating farm will have running water and soap readily available in case of accidental exposure. Technical assistance and training for farmers under this project will include pesticide management and safety, including demonstration of pesticide use safety practices, safety equipment, first aid procedures, and appropriate application techniques.

- **Fertilizers**: TVG will continue to require that soil from winter wheat production plots under its subgrant be tested to assess actual fertilization needs in each participating farm. TVG will also encourage crop rotation with alfalfa or other suitable legume as a long-term, sustainable alternative to applying expensive inorganic nitrogen-containing fertilizers.

- **Technical assistance**: A qualified U.S. based pest/pesticide management specialist, with expertise in weed management and holding a valid U.S. pesticide application license will be contracted, on a short-term basis, to assist with the presentation of weed/pesticide management training (section 3.11)), the screening and approval of pesticide storage facilities (section 3.10), and pesticide monitoring activities (section 3.12). Additional desirable tasks for this specialist are outlined in section 3.3. TVG will make this specialist available, at no cost to the subgrant, through its Farmer to Farmer Program.

- **Pesticide management under CARE**: As recommended for the TVG subgrant, CARE will assume full responsibility for the transport, storage, safe handling, application, and disposal of any pesticide procured with USAID funding. All pesticide application activities involving the use of organosynthetic pesticides will be supervised by a qualified agronomist or crop protection specialist with expertise in pest/pesticide management. Refer to section 3.6 for special instructions regarding the use and effectiveness of Novodor.

5.0 Proposed Action and Alternatives

5.1 The proposed action is implemented as originally proposed

Under its subgrant's proposed activities, TVG will provide training, technical assistance and commodity assistance to NGOs and farmers in Georgia in order to strengthen their capacity to access agriculture inputs and advisory services. A portion of the harvested grain will benefit an estimated 10,000 IDPs and other needy individuals. Short term

objectives for 1995 include re-building the indigenous seed production capacity through the distribution of approximately 150 tons of wheat seed, 200-250 tons of fertilizers, and 700 gallons of herbicides to plant 1200 ha of winter wheat for seed production. The fertilizer will be used to replenish the soil in target fields, which has been deprived of fertilizers during the past four years, with the nitrogen needed to ensure a satisfactory yield. Herbicides, are similarly needed to control a complex of hardy weed species that, otherwise, would compete with the wheat crop and cause a significant yield loss.

Although this activity is to be implemented under the guidance of qualified crop production consultants, without specific pest/pesticide management assistance and safeguards the risk of potential adverse environmental or health impacts increases unnecessarily.

5.2 No action alternative: No agrochemicals are used

Because at the subgrant sites the soil has been depleted of nutrients over the past four years, attempting to grow winter wheat without suitable fertilizers would guarantee a poor yield, thus defeating the purpose of the activity. Similarly, without appropriate herbicides, there would be a severe reduction in crop yield. Without access to these two agrochemicals, trying to grow wheat in the farms selected would not justify the effort, and TVG would probably not attempt it. A no action alternative, i.e. not approving the procurement/use of the requested agrochemicals, would effectively block TVG's initiative to help create local private sector capacity to produce and market wheat seed in Georgia. Since in this case the potential gains to be derived from the proposed TVG subgrant activity clearly outweighs the potential risks associated with the proposed agrochemicals use, the No Action Alternative is rejected.

5.3 Preferred alternative: The proposed action incorporates the recommendations listed in Section 4.0 of this EA

Under this alternative, designated in this EA as the Preferred Alternative, the implementation of the TVG's subgrant activities includes the timely implementation of each one of the recommendations provided in section 4.0.

6.0 Literature Consulted

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Appendix I. Persons contacted

Dato Bedoshvili	Save the Children, Georgia
William Furtick	Project Manager, Agricultural Cooperative Development International (ACDI)
Alexander Kavtaradze	Office Manager, ACDI
Paul Heinzen	Director, Tri Valley Growers (TVG)-Georgia
Irakli Khvadagadze	Special Assistant, ACDI
John Marks	Director, Save the Children, Yereban
Zurab Loladze	Head, Plant Protection Department, Georgian Scientific Center of Technical-Ecological Research. Leader of Private Farmers Union in Georgia.
Shalva Sarukhanishvili	Legal Specialist, ACDI
Vakhtang Shelia	Agro-Ecological Research Center and the Agricultural Academy of Georgia.
Tamaz Tourmanidze	Special Assistant, TVG. Director, Agroecological Society of Georgia
Stephen Vance	Save the Children, Georgia
Alexander Zedginidze	Agricultural Officer, International Rescue Committee (IRC)

APPENDIX II:

Common insect pests of wheat Georgia

Order Homoptera
- Family Aphididae
  - *Schizaphis graminum* (Greenbug)
  - *Sitobion avenae* (Grain Aphid)
  - *Brachycolus noxius* (... Aphid)

Order Hemiptera
- Familiy Scutelleridae
  - *Eurygaster integriceps* (Shield-Backed Bug)
- Family Pentatomidae
  - *Aelia acuminata, A. rostrata* (Stink Bugs)
  - *Haplothrips tritici* (Wheat Thrips)

Order Coleoptera
- Family Bruchidae
  - *Zabrus tenebriodis* (Caucasian Grain Weevil)
- Family Chrysomelidae
  - *Lema melanoplus* (Cereal Leaf Beetle)
  - *Chaetocnema aridula, C. hortensis* (Flea Beetles)
  - *Phyllotreta vittula* (Flea Beetle)
- Family Scarabaeidae
  - *Anisoplia austriaca* (Large Wheat Beetle)
  - *Anisoplia farraria* (Caucasian Beetle)
  - *Anisoplia leucaspis* (White-Shielded Wheat Beetle)
  - *Anisoplia alazanica* (Alazani Beetle)

Order Lepidoptera
- Family Noctuidae
  - *Apamea sorden* (Cutworm)

Order Hymenoptera
- Family Cephidae
  - *Cephus pygmaeus* (European Wheat Stem Sawfly)

Order Diptera
- Family Choloropidae
  - *Chlorops pumilionis* (Green-Eyed Fly)
  - *Oscinella frit* (Sweeden Frit Fly)
  - *Meromyza saltatrix* (Wheat Stem Maggot)
- Family Cecidomyiidae
  - *Maetiola destructor* (Hessian Fly)

Polyphagous insect species that attack wheat in Georgia

Order Orthoptera
- Family Acrididae
  - *Locusta migratoria* (Asian Migratory Locust)
  - *Dociostaurus maroccanus* (Moroccan Locust)
  - *Calliptamus italicus* (Italian Locust)
  - *Calliptamus tenuicercis* (Caucasian-Italian Locust)
- Family Gryllotalpidae
  - *Gryllotalpa gryllotalpa* (European Mole Cricket)
  - *Gryllus desertus* (Common Cricket)

Order Coleoptera
- Family Elateridae
  - *Agriotes gurgistanus, A. sputator* (Wireworms)
- Family Tenebrionidae
  - *Pedinus fomoralis*
- Family Scarabaeidae
  - *Amphimallon solstitialis* (June Beetle)
  - *Amphimallon pectoralis* (May Beetle)
  - *Pentodon idiota* (Maize Beetle)
  - *Polyphylla olivieri* (Caucasus Marble Beetle)